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Technical Report NPS/NRWRD/NRTR-2006/356

Groundwater Characterization and Assessment of Contaminants in Marine Areas of Biscayne National Park

Christopher Reich, Robert B. Halley, Todd Hickey,
and Peter Swarzenski

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Cover Photo: Grey Angelfish on Biscayne National Park coral patch reef; photographer unknown

GROUNDWATER CHARACTERIZATION AND ASSESSMENT OF CONTAMINANTS IN MARINE AREAS OF BISCAYNE NATIONAL PARK

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WATER RESOURCES DIVISION

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EXECUTIVE SUMMARY

Biscayne National Park (BNP) is adjacent to the Miami-Dade County South Dade Landfill Facility and the Miami-Dade Water and Sewer South District Plant. The base of the landfill is lined with a geotextile membrane to separate it from the underlying Miami Limestone, the host rock for the Biscayne Aquifer. The sewer plant injects treated sewage into the lower Floridan Aquifer that is overlain by an aquitard termed the Middle Confining Unit. The Biscayne Aquifer borders the western margin of BNP and the Floridan Aquifer underlies the entire park. There is concern about leakage of contaminated aquifer water into BNP and its potential effects on water quality.

Water samples from shallow nearshore and offshore wells in BNP have been analyzed to characterize the groundwater beneath the park and to assess the potential for contaminants entering the park from subsurface flow. Samples from seven well sites were collected approximately quarterly from August 2002 until March 2004. The well sites form a transect from the western shore of Biscayne Bay at Black Point southeastward across the shelf to Pacific Reef. Samples were analyzed for conductivity (salinity), dissolved oxygen, temperature, redox potential, nutrients, metals, strontium isotopes, radon, sulfate, and wastewater compounds.

Low-salinity water was present in nearshore wells and indicates either some leakage from the Biscayne Aquifer or surface-water intrusion. Elevated nutrients indicate surface-water exchange is more likely than groundwater flow. Lack of seasonal variation in groundwater salinity indicates minimal exchange either with the surface water or with fresh groundwater flow, both of which exhibit seasonal variation. The groundwater beneath the Florida shelf can be characterized as reduced (anoxic) seawater, modified by microbial respiration to remove oxygen and interaction with sediments and minerals in the host limestone. Analyses of 109 water samples collected from wells across the Florida shelf beneath BNP between August 2002 and March 2004 show no consistent evidence of wastewater contaminants occurring in groundwater beneath BNP. In addition, no significant upward leakage from the Floridan Aquifer was detected in the shallow groundwater beneath BNP. The western edge of Biscayne Bay is influenced by surface water and perhaps Biscayne Aquifer water, whereas the rest of the Florida shelf is underlain by uncontaminated marine groundwater.

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INTRODUCTION

Coral reefs worldwide are suffering a decline. This decline is a result of damage from ship groundings, point-source pollution, dynamite fishing, and ubiquitous but poorly understood effects of disease, coastal nutrification, and global warming. The Florida reef tract exemplifies reef decline in the Atlantic-Caribbean region with many reefs now exhibiting less than 10% live coral cover (Florida Fish and Wildlife Conservation Commission, 2004). As part of the Florida reef tract, the coral reefs of Biscayne National Park (BNP) have not been immune to the general decline, and great concern has been expressed by Department of Interior (DOI) managers and in the public media about the issue of continued degradation of reef ecosystems.

Coastal pollution has been of particular concern in south Florida because of the great increase in population and urban development. Reef decline during the past three decades has paralleled the growth of the Miami metropolitan and Florida Keys areas. This growth, and associated pollution and fishing pressure, have placed BNP among the top 10 endangered National Parks (National Parks Conservation Association, 2004). Pollutants can enter BNP through many pathways. BNP is connected to the surrounding urban area by roads, canals, waterways, water pipes, and electrical grids. Less apparent are the connections through wet and dry atmospheric deposition, surface seawater circulation, and groundwater flow. This study addresses the threat of pollutants entering BNP along the groundwater-flow path.

Groundwater in two south Florida aquifers, the shallow Biscayne and the deeper Floridan, is known to flow east and southeast from the mainland toward BNP (Fish and Stewart, 1991; McNeill, 2000). In addition, the Biscayne Aquifer is immediately overlain by both decommissioned (OSDL) and active landfills that lie on the western edge of BNP (Figure 1). Near the active landfill, a deep portion of the Floridan Aquifer is used for wastewater injection. Historically (prior to 1900), fresh groundwater from the Biscayne Aquifer discharged along the western shore of Biscayne Bay at greater volumes than those observed today. To simulate modern-day groundwater flow from the Biscayne Aquifer to the bay, a hydrogeologic model (SEAWAT) has been developed (Langevin, 2001). Connectivity between the Floridan Aquifer and surface water of BNP is unknown, although wells drilled to the Floridan are artesian and historically have had wellhead pressures of 10-20 psi at sea level (Bush and Johnson, 1988). The pressures have been decreasing over time with changing climatic conditions and aquifer withdraws.

Small brackish-water lenses occur beneath the larger islands of the Florida Keys such as Elliott Key, Key Largo, and Big Pine Key (Halley and others, 1997). Perhaps more importantly, the islands (keys) act as a barrier to tidal flow due to a large separation between tidal inlets (up to several kilometers). The presence of the keys causes a difference in tidal cycles and hence water levels, creating a hydraulic head gradient. The gradient constantly changes as the tide changes, setting up a phenomenon known as tidal pumping. Tidal pumping is the primary control or forcing factor for groundwater flow near the islands (e.g., Halley and others, 1997; Reich and others, 2002).

The objective of this study is to determine whether the shallow groundwater beneath Biscayne Bay and the outer-shelf reefs is being affected by activities on the mainland.

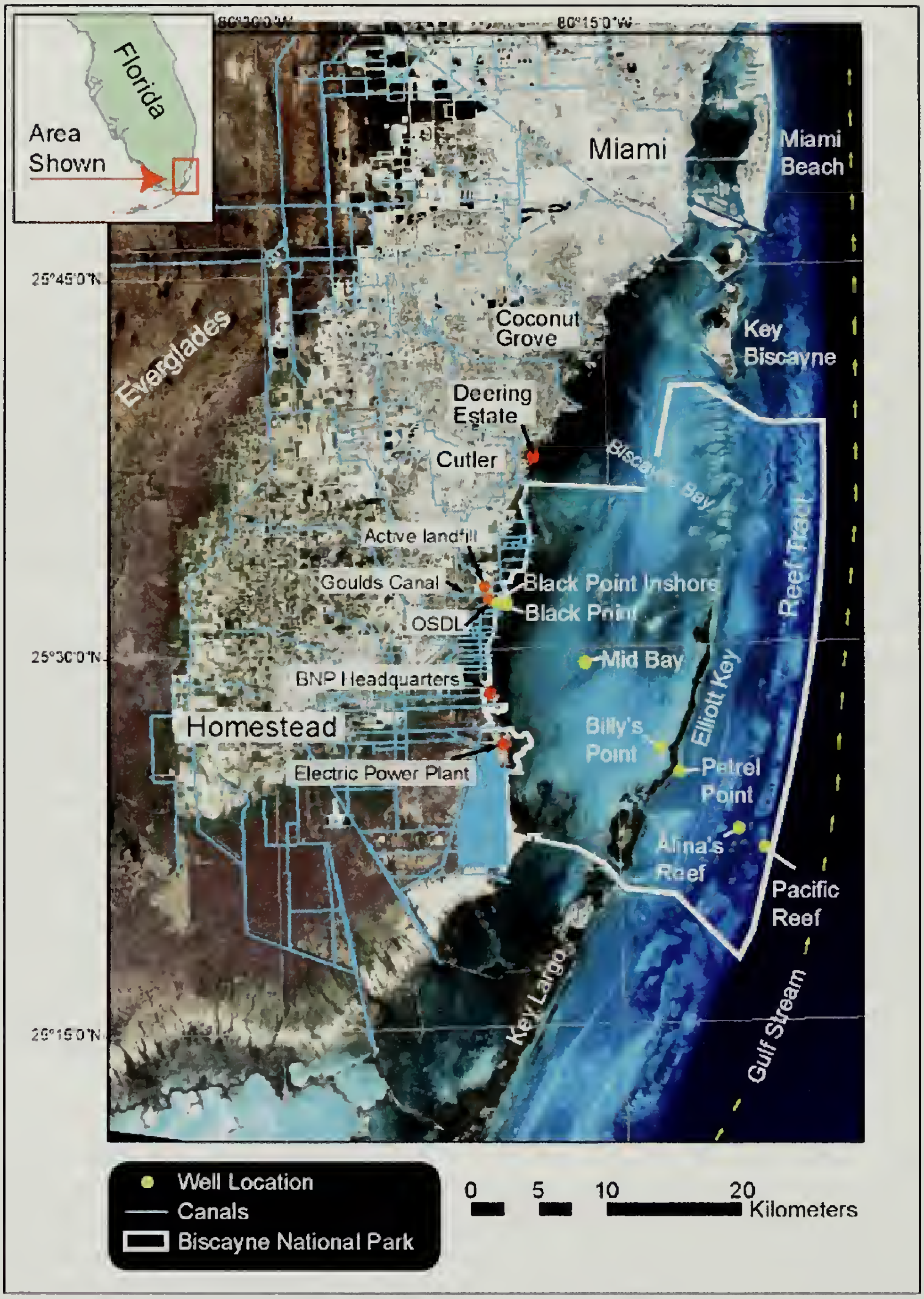

Figure 1. Study area and well-cluster sites indicated by yellow circles. Goulds Canal exits into the bay near Black Point. Landfills are marked with orange dots; active landfill is the South Dade Landfill Facility and the Miami-Dade Water and Sewer South District Plant. The Old South Dade Landfill (OSDL) is an inactive landfill.

The scope of this study included installation, sampling, and analyses of water from sub-sea monitoring wells aligned along a transect from the western shore of Biscayne Bay southeastward to the reef tract. Surface water at each well site was also collected. The water samples were then analyzed for potential and known contaminants in the Biscayne and Floridan Aquifers.

GEOLOGIC SETTING

The Miami Limestone composes the Biscayne Aquifer in large part, making it one of the most permeable aquifers in the U.S. (Fish and Stewart, 1991). In contrast, the modern sediments are generally less permeable (Enos and Sawatsky, 1981). The relative difference in permeability between sediment and rock, and the juxtaposition of sediment above the limestone, have led to the hypothesis that modern sediments may act as a partial aquiclude or seal over more permeable limestone on the seaward shelf. The surficial Pleistocene limestone of the mainland and the Florida Keys has been shown to be approximately 125,000 years old (Multer and others, 2002). Younger Pleistocene reef deposits, approximately 80,000 years old, have been identified along the shelf edge farther south in the Keys (Lidz and others, 1991; Toscano and Lundberg, 1998). Similar relations may exist in the Pacific Reef area, and the limestone below modern reef sediments may be as young as 80,000 years but has not been dated by appropriate techniques to verify that age. The Pleistocene limestone in the region has been exposed to weathering and karstification during periods of lowered sea level (Multer and others, 2002), evidenced particularly well in the Cutler Ridge area where karst surfaces and small sinks and caves occur south of the Deering Estate Preserve. Within Biscayne Bay, many of the seagrass patches grow in sediment-filled solution holes, similar to those documented by Ziemann (1972) in Florida Bay. Although the influence of karst on water flow has been recognized for many years (Parker and others, 1955; Shinn and Corcoran, 1987), only recently are attempts being made to integrate detailed knowledge of limestone dissolution with hydrogeology (Cunningham and others, 2003). About 15 miles south of BNP, a large, sediment-filled sinkhole occurs on the shelf behind a reef known as The Elbow (Shinn and others, 1996). No evidence of groundwater flow was observed from the sinkhole during study of this particular karst feature.

The Upper and Lower Floridan (Boulder Zone) Aquifers, respectively, are roughly 1000 to1800 ft and 2500 to 3000 ft below the surface of BNP. Historically, the aquifers are believed to be flowing slowly toward the shelf edge where they empty into the Florida Straits. Locally, these aquifers deepen eastward, and there is concern about leakage from the deep aquifer that is used for sewage disposal (McNeill, 2000). Regional changes in hydraulic head play the major role in flow of the Upper Floridan that has its recharge area in northwestern Florida. Lower Floridan flow is driven by an additional component of geothermal warming that causes warmer, less-dense water to rise beneath the Florida Platform and flow outward both on the Atlantic and Gulf of Mexico sides of the peninsula (Kohout, 1965). In Dade and Monroe Counties, artesian flow from wells drilled into these aquifers was encountered during exploratory well drilling. Natural springs and seeps from these aquifers are known to occur in north and central Florida as far south as 27° N, but not south of that latitude. Mud Hole Submarine Spring, believed to emanate from the Lower Floridan Aquifer, occurs in the Gulf of Mexico off Ft. Myers at 26° 15' 50" N (Fanning and others, 1981). No natural springs flowing from the Floridan Aquifer are known in Dade or Monroe Counties (Rosenau and others, 1998).

METHODS

Four tasks were undertaken to create the datasets for this study. (1) Sub-sea monitoring wells were installed along a transect from near shore to offshore. (2) Samples from wells and surface waters were collected approximately quarterly as weather allowed. Surface-water samples were collected immediately above the well-cluster sites. (3) Samples were analyzed using standard operating procedures wherever possible. (4) Water-level (well-pressure) data were collected at selected sites using submersible pressure sensors.

Well Locations

Six well-cluster sites have been established in a 25-km-long transect leading from onshore to offshore (Figure 1 and Table 1). The near shore site 1 (Black Point Inshore) is a single well located south of Black Point. The well head is approximately 2 ft below sea level, and the well penetrates to a depth of 17 ft below seafloor (fbsf), terminating in a quartz-sand zone of the Miami Limestone (Fish and Stewart, 1991). Site 2 (Mid-Bay) is located in the middle of Biscayne Bay approximately 9 ft below sea level and consists of three monitoring wells to depths of 15, 33, and 42 fbsf. Sites 3 and 4 are located on opposite sides of Elliott Key. Site 3 (Billy's Point), the bayside site, consists of two wells at 6 and 22 fbsf. Site 4 (Petrel Point), the seaward site, consists of two wells at 20 and 45 fbsf. Site 5 (Alina's Reef) is located on a patch reef where diverse reef research and monitoring is continuing and is a site where BNP staff have recorded low conductivity (salinity) on a moored instrument (Porter and Porter, 2002, p. 12-13). Three wells installed at Alina's Reef provide sampling access to 12, 32, and 60 fbsf. Site 6, located south of the Pacific Reef light structure, consists of two monitoring wells to depths of 10 and 41 fbsf. Procedures used to complete all monitoring wells are described below. For comparison, a pre-existing shallow (80 ft, below land surface) onshore well in the Biscayne Aquifer was sampled, as well as an additional well (BkP, 20 fbsf) located just offshore of the Black Point site.

Well Installation

Well installation was accomplished by SCUBA divers with surface support. A USGS work boat, hydraulic-powered drill, and standard 5-ft NQ-2 wire-line core barrels and drill rods were used for core drilling. SCUBA divers drilled most of the offshore wells. Wells can range in depth from 10 to 60 ft (3-20 m) and can be installed both on land and offshore in water depths up to 20 ft (6 m) (Figure 2). Rock cores obtained during drilling are 2 in. (50 mm) in diameter. Each hole drilled was completed as a water-quality monitoring well (see Shinn and others, 1994, for diagrams of well completion). A flush-threaded 5-ft-long, 2-in.-ID PVC well screen with 0.01-in. slots was attached to enough PVC casing (flush threads) such that between 1 and 2 ft of casing protruded from the open hole. Two well sites, at Alina's Reef and Pacific Reef, were completed using 1-in.-ID PVC screen and casing due to caving of the borehole. Coarse quartz sand (20-40 silica sand was poured into the annulus of the borehole to fill the

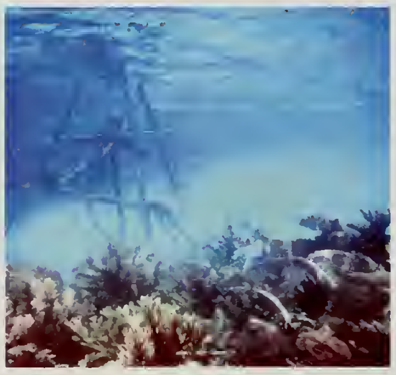

Figure 2. Drilling on Alina's Reef using SCUBA.

space between the screen and formation. Too coarse to clog well-screen slots, the sand allows unrestricted passage of fluid from the porous limestone to the screen.

Location ID	Station Name	Longitude (W)	Latitude (N)	Date	Method Lat/Long	Datum Lat/Long	Water Depth (ft)	Drilled Depth below Seafloor
BPI-1A	Black Point Inshore	-80.330	25.526	06/02/02	PLGR P-code	WGS 84	1	17
BkP-1A	Black Point-1A	-80.324	25.526	05/11/96	PLGR P-code	WGS 84	2	20
MB-1A	Mid Bay -1A	-80.267	25.484	06/10/01	PLGR P-code	WGS 84	9	45
MB-1B	Mid Bay -1B	-80.267	25.484	06/13/01	PLGR P-code	WGS 84	9	55
MB-1C	Mid Bay -1C	-80.267	25.484	06/13/01	PLGR P-code	WGS 84	9	15
ByP-1A	Billy's Point -1A	-80.212	25.428	06/07/01	PLGR P-code	WGS 84	3	22
ByP-1B	Billy's Point-1B	-80.212	25.428	06/09/01	PLGR P-code	WGS 84	3	16
PP-1A	Petrel Point-1A	-80.204	25.415	06/05/01	PLGR P-code	WGS 84	1 .5	45
PP-1B	Petrel Point-1B	-80.204	25.415	06/06/01	PLGR P-code	WGS 84	1.5	20
AR-1A	Alina's Reef-1A	-80.163	25.386	06/16/01	PLGR P-code	WGS 84	9	60
AR-1B	Alina's Reef-1B	-80.163	25.386	06/16/01	PLGR P-code	WGS 84	9	32
AR-1C	Alina's Reef-1C	-80.163	25.386	06/16/01	PLGR P-code	WGS 84	9	12
PR-1A	Pacific Reef-1A	-80.142	25.371	06/01/02	PLGR P-code	WGS 84	12	42
PR-1B	Pacific Reef-1B	-80.142	25.371	06/01/02	PLGR P-code	WGS 84	12	10

Location ID	Top of Screen	Bottom of Screen	Sed. Thickness	Casting Type	Casting Diameter	Cores	Core Location
BPI-1A	12.0 ft	17.0 ft	1 ft	PVC	2.0 in	yes	St. Petersburg, FL
BkP-1A	15.0	20.0	1	PVC	1.5	yes	St. Petersburg, FL
MB-1A	28.0	33.0	0	PVC	2.0	yes	St. Petersburg, FL
MB-1B	36.5	41.5	0	PVC	2.0	yes	St. Petersburg, FL
MB-1C	10.0	15.0	0	PVC	2.0	yes	St. Petersburg, FL
ByP-1A	17.0	22.0	0	PVC	2.0	yes	St. Petersburg, FL
ByP-1B	1.0	6.0	0	PVC	2.0	yes	St. Petersburg, FL
PP-1A	40.0	45.0	0	PVC	2.0	yes	St. Petersburg, FL
PP-1B	15.0	20.0	0	PVC	2.0	yes	St. Petersburg, FL
AR-1A	55.0	60.0	0	PVC	1.0	yes	St. Petersburg, FL
AR-1B	27.0	32.0	0	PVC	1.0	yes	St. Petersburg, FL
AR-1C	7.0	12.0	0	PVC	1.0	yes	St. Petersburg, FL
PR-1A	36.0	41.0	0	PVC	1.0	yes	St. Petersburg, FL
PR-1B	5.0	10.0	0	PVC	1.0	yes	St. Petersburg, FL

Table 1. Location and drilling details for wells used in the study.

A slurry of Portland cement was then poured into the annulus to fill voids and irregularities in the rock. The cement prevents water in the annulus, higher in the well, from entering the screened zone. Quick-setting hydraulic cement, composed of 1 part molding plaster (plaster of Paris) and 7 parts type II Portland cement, was mixed with water to form a stiff ball. The ball of cement was quickly taken to the bottom and hand-molded into the annulus around the PVC pipe. The plug of cement in the top of the hole creates a barrier between the borehole and surface water. Hydraulic cement sets in approximately 5 min and is very hard in a few hours. Next, the excess PVC pipe was sawed off with a hacksaw, leaving 15 to 30 cm protruding above the surface. A tight-fitting PVC end cap sealed the wells. Once the cement had hardened, the wells were developed by pumping until the water ran clear. Purging was accomplished by fitting a PVC end cap (equipped with 3/4-in. by 50- ft-long, 15-m, Tygon hose) over the 2-in.-diameter PVC wellhead. The other end of the hose was attached to a small 12-VDC-rubber impeller pump aboard the boat. The water pump, with a discharge rate of approximately 5 gal/min, was run for 5 to 10 min or until the water ran clear. The completed wells were allowed to equilibrate for 90 days before sampling commenced.

Water Sampling

Ground- and surface-water samples were collected using USGS water-quality sampling protocols that follow clean procedures for all constituents, whether constituents are nutrients, trace elements, wastewater compounds, or pesticides (Wilde and others, 1998). The following sections describe preparation, collection, preservation, and cleanup procedures.

Preparation

The bottles for each constituent went through a four-step cleaning process. The bottles (except baked-glass bottles) were first washed in Liquinox, then rinsed in tap water, followed by soaking in a 10% HCl solution for 30 min, and finally rinsed in de- ionized (DI) water. The same procedure was followed for all tubing, fittings, and equipment (the acid rinse was not used on metallic equipment). Bottles were capped, and labels placed on the bottles. Prior to field collection, bottles were pre-rinsed twice with de-ionized (DI) water to save time in the field. Bottles were sorted for each well site and placed in double zipper bags. The same double-bagging method was used for tubing and other equipment and supplies that would come in contact with water samples. Three or four days prior to field sampling, Gelman capsule filters (0.45-μm) were pre-conditioned with DI water. As long as pre-conditioned filters are kept on ice or refrigerated, the shelf life is up to 2 weeks.

Collection

Once on site, a diver was sent to connect a fitting to the wellhead. The fitting provided a tight seal so that surface water could not enter when pumping commenced. The fitting was attached to Polytetrafluoroethylene (PTFE) tubing that reached from the wellhead to the boat. The PTFE tubing was connected to peristaltic tubing (C-flex), which passed through a peristaltic pump and was then split, with one tube leading to a multi-probe (temperature, pH, oxygen-reduction potential (ORP), salinity, and dissolved oxygen) and the other to the sampling chamber. Several well volumes of water were pumped from the well. After readings on the probe stabilized, values

were recorded in a notebook. The tubing to the probe was clamped and flow to the chamber commenced. Throughout water collection, 'clean hands/dirty hands' procedures were followed.

Figure 3. Equipment and collection-chamber layout on the R/V *Halimeda* in Biscayne National Park. Collection chamber, peristaltic pump, and flow-through multi-parameter probe can be seen on the table.

A collection chamber was assembled, which was constructed of a PVC frame with a clear Polyethylene bag clipped to the frame (Figure 3). The chamber created an enclosure where samples were collected in bottles and helped assure that atmospheric deposition or other possible sources of contamination did not enter the sample. The person designated 'dirty hands' opened the outer zipper bag and the person designated 'clean hands' pulled the inner zipper bag out and placed it in the chamber. Only the 'clean-hands' person touched the bottles and tubing inside the chamber. Bottles were rinsed once and then filled to the appropriate level. This procedure was conducted for all bottles for each well. Finally, the bottles were removed from the chamber for preservation (acidification).

Preservation and Cleanup

Some studies require a second chamber called a preservation chamber for acidification of samples. After each well site was sampled and before anchor is pulled to move to next well site, the tubing was rinsed with a 0.1% Liquinox solution and followed by a DI rinse until Liquinox soap residual was unnoticeable.

Sample Analyses

Salinity (specific conductance), temperature, dissolved oxygen (DO), oxidation- reduction potential (ORP or Redox), and pH were measured in the field using a multi- parameter probe (YSI model 556MP). Hydrochemistry for 64 trace elements (Table 2) were analyzed by inductively coupled plasma mass spectrometry (ICP-MS) at Actlabs- Skyline in Tucson, Arizona.

	Detection Limit	
Element	IPC/MS	ICP/OES
Li	0.1	0.05 mg/l
B	1**	1
Be	0.05	2
Ma	5	0.1 mg/l
Mg	1	0.1 mg/l
Al	2	0.1 mg/l
Si	50	0.1 mg/l
K	10	0.1 mg/l
Ca	50	0.1 mg/l
Sc	1	
Ti	0.1	10
V	0.05	10
Cr	0.5	20
Mn	0.05	0.1 mg/l
Fe	5	0.1 mg/l
Co	0.005	2
Cu	0.1	2
Ga	0.01	
Ge	0.01	
Se	0.2	20
Rb	0.01	
Sr	0.04	10
Y	0.003	10
Zr	0.01	
Nb	0.005	
Mo	0.01	5
Ru	0.01	
Pt	0.01	
Pd	0.01	
Ag	0.05	5
Cd	0.01	2
In	0.001	

	Detection Limit	
Element	IPC/MS	ICP/OES
Sn	0.05	10
Sb	0.01	10
Te	0.01	10
I	1	
Cs	0.002	
Ba	0.1	20
La	0.001	
Ce	0.002	30
Pr	0.001	
Nd	0.004	
Sm	0.002	
Eu	0.001	
Gd	0.002	
Tb	0.001	
Dy	0.001	
Ho	0.001	
Er	0.001	
Tm	0.001	
Yb	0.001	
Lu	0.001	
Hf	0.002	
W	0.02	10
Re	0.001	
Os	0.002	
Au	0.002	
Zn	0.5	5
Hg	0.2 (0.006+)	
Ti	0.005	10
Pb	0.1	10
Bi	0.01	20
Th	0.001	
U	0.001	0.05 mg/l

Table 2. Hydrochemistry of water samples run by Actlabs-Skyline. Samples within normal ranges were run on ICP/MS while others at high concentrations were run on ICP/OES (Optical Emission Spectrometry). Detection limits are in micrograms per liter (ppb) unless noted otherwise.

Three elements (arsenic, nickel and bromine), typically determined in fresh water by this method, had serious interferences from the high concentrations of calcium and magnesium in seawater and had to be excluded from the results. Groundwater and surface-water nutrients (ammonium, nitrates, nitrites, total soluble nitrogen, total soluble phosphorus, and soluble reactive phosphorus) were analyzed on a nutrient auto-analyzer at the University of Florida. Dissolved organic carbon (DOC) was analyzed at the USGS Water Quality Laboratory in Ocala, FL, on a Shimadzu TOC-5050A analyzer with an ASI-5000A auto sampler. Determination of 66 wastewater compounds in ground- and surface-water samples were conducted at the U.S Geological Survey National Water Quality Lab in Denver, CO. USGS analytical procedures for

wastewater compounds (USGS schedule 1433) were by solid-phase extraction (SPE) and subsequent gas-chromatograph mass spectrometry (GC-MS) analyses (Zaugg and others, 2002). Radium and radon samples were analyzed at the USGS Center for Coastal and Watershed Studies (CCWS) office in St. Petersburg. The St. Petersburg lab used an alpha-scintillation counter for measuring the four isotopes of radium (223, 224, 226, and 228). Strontium-isotope ratios (^{87}Sr to ^{86}Sr) were determined for selected samples by the University of Florida in Gainesville (August 2002) and Geochron Laboratories in Cambridge, MA (March 2004) using thermal ionization mass spectrometry (TIMS).

All samples were shipped immediately (via FedEx) upon return to the CCWS office in St. Petersburg. Holding times for nutrients were <28 days per USGS protocols when kept frozen; ^{223}Ra and ^{224} Ra were run in house as soon as possible due to their short half-life (11.4 days and 3.7 days, respectively); trace elements were shipped to Actlabs and run within 4 to 6 weeks; and wastewater compounds were run in the order in which they were received at the USGS National Water Quality Laboratory (Denver, CO). Turn-around time ranged from 6 to 8 weeks.

Potentiometric Measurements

Our fourth task was to investigate the hydrology of the region by installing pressure transducers in many, if not all, of the wells. The transducers were started, placed in the wells, and left to collect data on pressure variations within the wells. A transducer was also mounted to the outside of the well to collect data on surface water-level changes (tides). Well- and surface-pressure data were compared to determine if potentiometric gradients occurred between subsurface and surface that would indicate either positive vertical flow (discharge) or negative vertical flow (recharge). This part of the study is ongoing, funded by the USGS Eastern Region, and is not reported here. The information will be useful for calculating nutrient or other chemical-enrichment loading of surface water by groundwater.

RESULTS

Water Analyses

Results of analyses of surface- and groundwater samples are tabulated in Appendix A and shown graphically in Appendix B. Here we show the results for salinity, dissolved oxygen, pH, nutrients, metals, and wastewater indicators.

Basic Characterization

Salinity is arguably the most obvious indicator of Biscayne (salinity near 0 parts per thousand, ppt) or Floridan Aquifer (salinity about 2 ppt) water entering seawater (salinity about 35 ppt). Salinity of coastal surface water can also be affected by precipitation, evaporation, and surface-water runoff. The range of surface-water salinity encountered during the study period (Figure 4A and Appendices A2 and B1) was consistent with the known variability of salinity in the bay and offshore as shown by surface-water quality monitoring sites

(http://serc.fiu.edu/wqmnetwork/). The lowest salinity and greatest variability were observed at the near shore sites, which are most affected by rainfall and runoff. Variability diminishes greatly offshore to normal seawater salinity of the reef tract that is maintained primarily by the salinity of the Gulf Stream. Groundwater salinity ranges are shown in Figure 4B. Samples from an onshore well (G-3613) in the shallow Biscayne Aquifer are shown for comparison. Only the Black Point Inshore (BPI) well consistently exhibited a pronounced and consistent low salinity of about 21 ppt, indicating possible dilution by Biscayne Aquifer water. The offshore Black Point (BkP) and Petrel Point wells showed slight decreases in salinity (32- 33 ppt), perhaps reflecting some brackish-water mixing from the Biscayne Aquifer and the lens beneath Elliott Key, respectively.

The range of surface-water temperatures (Figure 4C) reflected seasonal temperature change, also moderated by the temperature of the Gulf Stream to the east. Maximum ranges were recorded in the western bay, and minimum variation occurred on the reef tract. Groundwater wells all showed an expected decrease in seasonal temperature variation, but their variation was greater than that of the onshore well (G- 3613, Figure 4D).

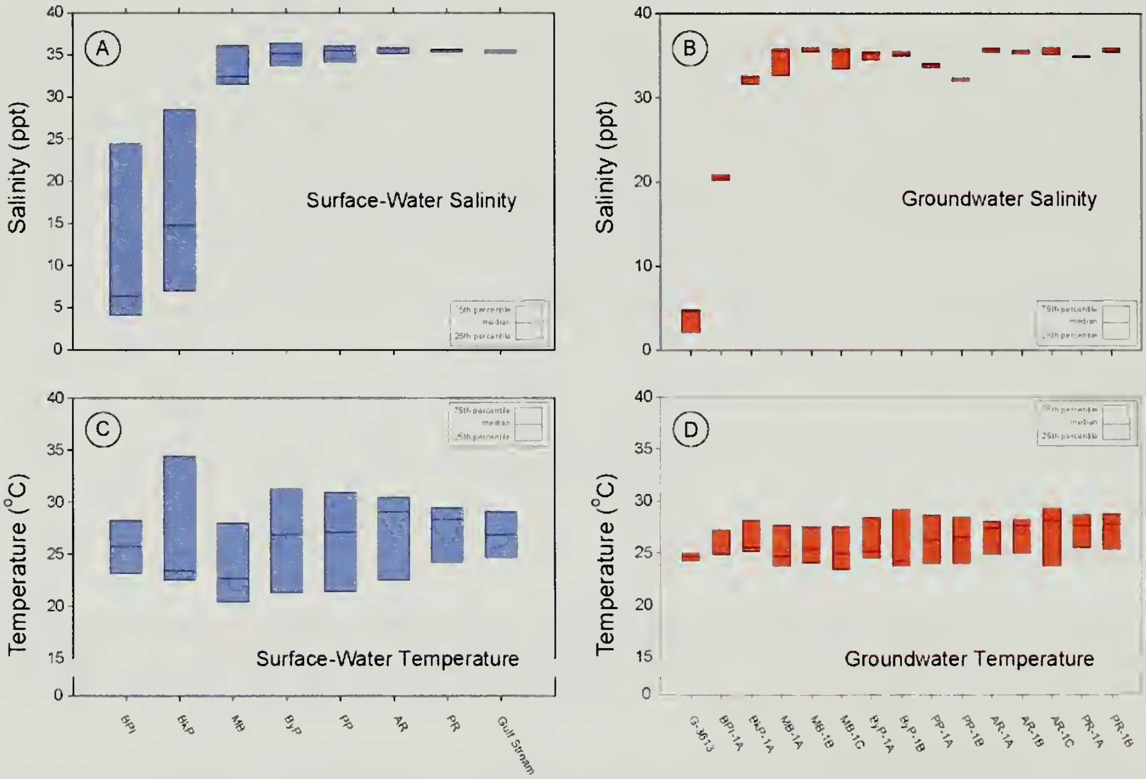

Figure 4. Statistical box plot of (A) surface-water salinity, (B) groundwater salinity, (C) surface-water temperature, and (D) groundwater temperature for the five sampling rounds.

DO, DOC, and Nutrients

Dissolved oxygen (DO) was depleted in groundwater relative to that of overlying seawater. Surface waters were generally near saturation with respect to oxygen, but groundwater generally

exhibited only a fraction of a percent saturation, nearing 2-3% in a few samples.

Dissolved organic carbon (DOC) in surface water was concentrated near the western shore of the bay (Appendices A1 and B2). In groundwater samples, DOC was also greatest along the western shore of the bay, with a secondary enrichment at Petrel Point. At the other well sites, surface-water and groundwater values were similar.

With the exception of near shore sites, surface water contained very little soluble silicate (SiO_2). Groundwater typically contains an order of magnitude more silica, perhaps as a result of groundwater interactions with quartz sand, than that observed in surface waters. Similarly, the onshore well exhibited high concentrations of nitrate, nitrite, dissolved inorganic nitrogen, and total soluble phosphorous. In contrast, relatively little ammonium exists in Biscayne Aquifer water compared to some surface-water samples from the Black Point Inshore site. Farther offshore in the bay and on the reefs, surface-water nutrient concentrations were low (compared to near shore values), but groundwater was consistently elevated relative to overlying seawater.

Metals

Of the 64 elements analyzed, 19 were found to be above detection limits. The distributions of these elements in groundwater are listed in Appendices A1 and A2 and shown graphically in Appendix B3. Also shown is an average value from ocean water from Millero (1996). Some obvious differences occurred in the nearshore wells as a result of mixing seawater with the Biscayne Aquifer. These included low values of boron, calcium, lithium, magnesium, sodium, potassium, strontium, and vanadium in the Black Point wells. Farther offshore, these metals have similar values in seawater and groundwater, with a slight tendency toward higher values in surface water, perhaps as the result of surface evaporation.

Wastewater Compounds

Results of analyses for wastewater compounds are listed in Appendices A3 and A4. Of the suite of compounds analyzed, none were found to occur consistently at any sample site. Only three compounds (DEET, acetophenone, and total para-nonylphenol) were encountered above the method-reporting limits (MRL) during this study. All of these compounds were also encountered in field blank samples (de-ionized water samples that have undergone similar collection procedures as ground and surface water samples).

Radium and Radon Isotopes

During two field efforts in August 2002 and June 2003, we analyzed several groundwater and surface-water samples from select sites within BNP for radium-223 (^{223}Ra) and excess radium-224 ($xs^{224}Ra$) as well as water-column radon-222 (^{222}Rn) activities (Appendix A5). During August 2002, average groundwater activities of ^{223}Ra and $xs^{224}Ra$ were 113.6 and 633.3 disintegrations per minute (dpm) $100L^{-1}$, respectively, while the average groundwater $xs^{224}Ra/^{223}Ra$-activity ratio was 10.2. In contrast, surface waters had expectedly much lower $xs^{224}Ra$ and ^{223}Ra activities (10.9 and 24.1 dpm $100L^{-1}$ respectively) and an activity ratio ($xs^{224}Ra/^{223}Ra$) of 2.8. The $xs^{224}Ra/^{223}Ra$ ratio value is in close agreement with an average

Biscayne Bay surface water xs^{224}Ra/^{223}Ra activity ratio of 2.0 in water collected during a subsequent submarine groundwater investigation of Biscayne Bay (Swarzenski and others, 2004).

In August 2002, excess ^{222}Rn activities were determined in select groundwater samples from wells within BNP. From five offshore wells, the average excess ^{222}Rn activity was 256.8 dpm L^{-1}, whereas an onshore well had an activity of 939.2 dpm L^{-1}. From a recent 2004 surface-water radon survey, Biscayne Bay had an average background surface-water ^{222}Rn activity of 2-3 dpm L^{-1} (Appendix A5; Swarzenski and others, 2004).

Strontium Isotopes

Strontium-87/86 for 19 water samples was determined (Appendix A6). One sample was collected from an approximately 1500-ft-deep well on Elliott Key that supplies a BNP reverse-osmosis plant with water from the Upper Floridan Aquifer. The other 18 samples are from the onshore-to-offshore transect of shallow wells. Plotting the $^{87/86}$Sr of these samples against salinity (Figure 5) shows how low-salinity samples fall along a mixing line between Biscayne Aquifer water and seawater. No samples were encountered that have low salinity as a result of mixing with Floridan Aquifer water.

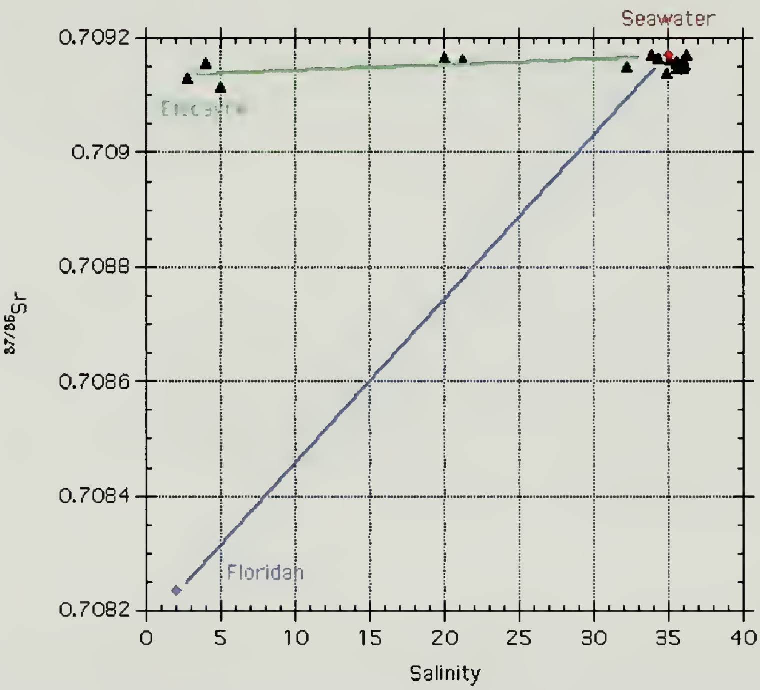

Figure 5. Most well samples had $^{87/86}$Sr typical of seawater (red circle). Water samples from nearshore wells fell along a mixing line between seawater and Biscayne Aquifer water (green line). Samples indicating mixing between Floridan Aquifer water and seawater (blue line) were not found.

DISCUSSION

Langevin (2001) estimated that groundwater discharge from the Biscayne Aquifer to the bay is approximately 6% of the surface-water flow into the bay. Nearly 100% of the groundwater contribution enters the bay north of the Cutler Drain Canal, about 5 miles north of the Black Point wells, where there is significant topography onshore that helps maintain hydraulic head and groundwater flow. Brackish water was consistently encountered only in the Black Point Inshore (BPI) well. There is little seasonal variability in groundwater salinity, in contrast to surface waters that vary strongly between seasons, implying that the inshore wells are not subject to exchange with surface water on a seasonal basis. This effect is particularly apparent in wells BPI and BkP (Figure 4B). A relatively small temperature variation at the BPI site may be the result of moderation by groundwater discharge prominently from the Biscayne Aquifer.

The Black Point well (BkP) farther offshore consistently maintained greater salinity than surface water during the study. The higher salinity may indicate that the depth and distance of this well is beyond the influence of the Biscayne Aquifer. The BkP well and the other wells contained only marine groundwater during the course of the study. Although consistently marine, the Petrel Point well was 1 to 2 ppt less saline than other bay or offshore wells. The lowered salinity may be the result of mixing seawater with the brackish lens beneath Elliott Key and subsequent eastward flow due to tidal pumping, similar to that described at Key Largo (Reich and others, 2002).

One of the factors controlling groundwater flow to the bay is the geologic framework of the region. Knowledge about variability through the Biscayne Aquifer was accomplished by drilling that produced rock cores and allowed observations to be made on the geologic materials that compose the shallow subsurface of BNP. Lithologic core logs are shown in Appendix C. The cores, together with the well-known geology of the mainland (Fish and Stewart, 1991) and previous studies of the shelf geology (Perkins, 1977; Shinn and others, 1989; Lidz and others, 1997), provide the basis for a schematic cross section illustrating the various rock types and sediments beneath the seafloor (Figure 6). The cores show that along the transect from NW to SE, Biscayne Bay is underlain by the uppermost marine stratigraphic units (Q3 – Q5; Quaternary units described by Perkins, 1977) of the Miami Limestone. These units are separated by exposure horizons, surfaces that were weathered during low stands of sea level during the mid-to-late Pleistocene. In this part of the bay, the limestone is typically overlain by less than 6 in. of modern carbonate sediment (Wanless, 1967). A facies change occurs at Elliott Key to more reefal limestone as the Miami Limestone grades laterally into the Key Largo Limestone. The Billy's Point core did not encounter reefal limestone, which indicates the transition is laterally abrupt here, perhaps only a few tens of meters from this well to the Key Largo Limestone exposed on Elliott Key. The Key Largo Limestone is veneered with modern sediments east of Elliott Key and is increasingly buried by modern sediment east of Hawk Channel. Assuming this area of the reef tract is similar to the shelf margin off central Key Largo (Lidz and others, 1997) modern sediment in the vicinity of Alina's Reef may be 12-18 ft thick and 20-30 ft thick at Pacific Reef.

Taken together with the strontium-isotope analyses (Figure 5), the salinity of groundwater wells in BNP indicates that there may be very limited flow from the Biscayne Aquifer along the extreme western shore of Biscayne Bay near Black Point. There is no evidence from the $^{87/86}Sr$

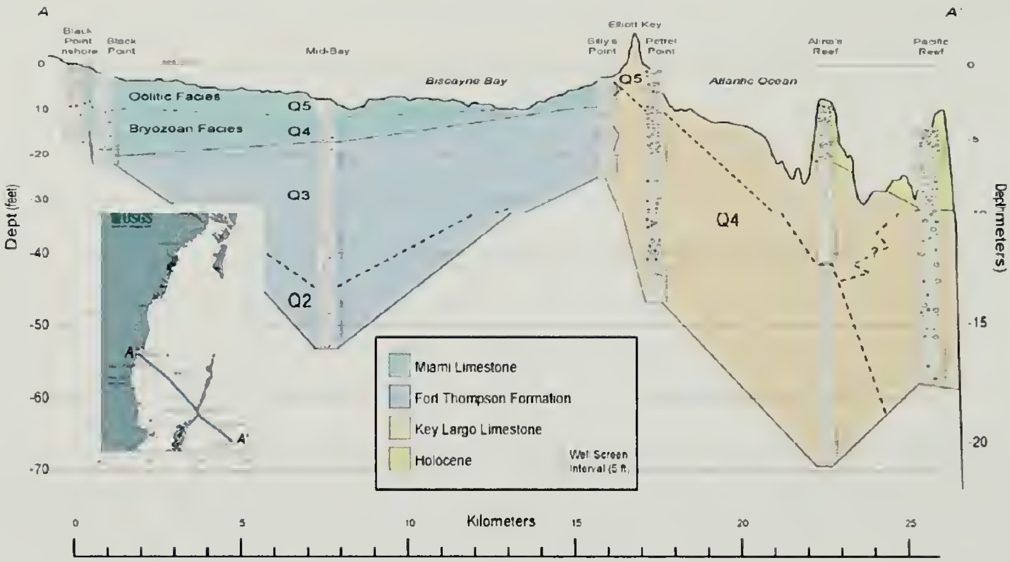

Figure 6. Geologic cross-section showing core sites and interpretations across the southeast Florida shelf. (vertical exaggeration is 1:650; for key to lithologic patterns see Appendix C)

measurements that the Floridan Aquifer is significantly contributing water to BNP. The ratio of Sr isotopes with atomic weight 87 to 86 ($^{87/86}$Sr) has been steadily increasing in seawater for the past 40 million years (Howarth and McArthur, 1997), during the time when the carbonate rocks of the Floridan and Biscayne Aquifers were being deposited. Carbonate aquifers, in turn, often transfer their strontium isotopic values to pore water, because there is much more strontium in the rock matrix than in the pore fluid. Strontium isotope values from the Floridan Aquifer are distinctly less (older) than those of modern seawater (Schmerge, 2001). The Biscayne Aquifer rocks are so recent in origin (geologically speaking) that they may appear only slightly older than modern seawater. Mixing of a few percent Floridan Aquifer with surface water would be evident because isotopic compositions are markedly different. Porter and Porter (2002) suggested that a conductivity record from Alina's Reef was evidence of polluted groundwater beneath the reefs. We did not observe low- salinity water at the reef or abnormally elevated chemical constituents that might indicate a source of land-based pollution. It is possible that some other processes were affecting the conductivity reported by Porter and Porter (C.D. Langevin and J. Wang, personal communication, 2004).

The concentrations of nutrients found in marine groundwater are not excessive. Similar concentrations are found to the south off the Florida Keys (Shinn and others, 1994) and beneath Florida Bay (Reich and Shinn, 2003). High concentrations of nutrients in brackish water near shore appear to be more closely related to surface water than to groundwater flow. Although the Biscayne Aquifer samples from the onshore well are elevated in nutrients, there are insufficient concentrations in groundwater beneath the bay to implicate a significant contribution from onshore groundwater. For nitrate and nitrite, the surface water at BPI and BkP is consistently enriched relative to groundwater. This observation, together with surface-water analyses conducted by Meeder and Boyer (2001) and Brand (2002), indicates that nitrate and nitrite levels in the near shore wells are more the result of local denitrification than direct flow from Biscayne

Aquifer water. Nutrients determined in these wells appear to be within the range of groundwater values reported by D'Elia and others (1981) for groundwater influx to the reefs in Discovery Bay, Jamaica.

The greater concentrations of silica in near shore surface water may be an indication of interaction of groundwater with quartz sand encountered at BPI or co- mixing of groundwater and surface water. The relatively high concentrations of these nutrients found at near shore sites may, in part, reflect the groundwater contribution to the bay along its western margin. The concentrations indicate that near shore ammonium (NH_4^+) may be primarily associated with runoff to the bay or with decaying organic matter.

Biscayne Bay sediments are known to contain elevated levels of some heavy metals, primarily north of BNP (Hoare, 2002). In particular, lead, silver, copper, zinc, and mercury have been identified as contaminants in some sediment samples (Corcoran 1984; Corcoran and others, 1984; Hoare, 2002). Shinn and Corcoran (1987), however, did not find significant concentrations of heavy metals in groundwater from onshore wells near Goulds Canal. Results from this study did not find excessive concentrations of these metals in bay surface water. The common heavy elements are enriched in groundwater because they have a source in the surrounding rocks and sediments and they become more soluble in lower pH (reduced) groundwater. These elements include aluminum, barium, copper, iron, lead, and zinc. There are no standards for most metals determined during this study, particularly for seawater. Although heavy metals are often enriched and more soluble in reduced groundwater, their surface-water concentrations do not appear to be excessive when compared to oceanic waters (Millero, 1996). In coastal waters, metal concentrations can be considerably greater than in the open ocean but are much less than those acceptable for drinking water. For example, copper, lead, and zinc guidelines for drinking water are 1000, 15, and 5000 ppb. In Biscayne Bay surface water, these metals are about 150, 2, and 10 ppb, respectively.

Shinn and Corcoran (1987) found traces of pesticides, plasticizers, and aliphatic hydrocarbons in samples from shallow wells (15 and 30 ft) in the Biscayne Aquifer south of the Goulds Canal. Concentrations at 30 ft were about half that of the 15-ft sample. The contaminants were not found in a well on the north side of Goulds Canal, nearer the landfill. This distribution indicates that contamination may be local, on the south side of the canal, and may be the result of surface water entering the Upper Biscayne Aquifer. During this study, wastewater compounds in groundwater (G-3613, BPI-1A, MB-1B, and AR-1B) were encountered in 3.5% of the samples and in 5.2% of the surface-water samples (BPI and Gulf Stream). Twenty-two different compounds were recognized in samples and field blanks. Nineteen of the 22 compounds were detected below the method-detection limit (MDL), indicating that while present, they are not of sufficient concentration to be measured accurately by the methods used in this study. Eight of the compounds occurred in blanks, six of those occurred below MDL. Twelve of the compounds were single occurrences. The most commonly recognized compound was DEET, occurring in nine surface-water samples, 16 groundwater samples, and four blanks. Only DEET, acetophenone, and total para-nonylphenol were encountered above the MDL. DEET and acetophenone are components of personal-care products, and total para-nonylphenol is used in detergents. Although QA/QC procedures were carefully followed, the unusual field conditions during sample and blank collections may have resulted in contamination. It is also possible that

because of the extremely low detection limits for these compounds, generally in the range of 0.5-1 ppb, some contamination could occur during transport and analyses. No contaminants were detected consistently at any sample locations. Nor were any contaminants found to be above the MDL that did not also occur in blanks (sampling/transport/analysis contamination). A recent study statistically comparing results from 13 study units across the United States has shown that similar compounds and concentrations as found in this study (e.g., acetophenone, phenol and DEET) have also been found in field and source-solution blanks (de-ionized water samples that have not come into contact with sampling equipment) (J. Kingsbury, pers. comm., 2004).

The limestone beneath BNP is very porous and permeable and is expected to exchange water with the surface. Whereas this exchange may occur quickly in high-energy offshore settings (Tribble and others, 1992), the exchange may take as long as a few decades in similar inshore sites (Böhlke and others, 1997). In particular, the modern sediments of the middle shelf form a comparatively low-permeability layer, restricting limestone beneath from surface exchange and creating a leaky trap for groundwater rising from below. Wells at Alina's Reef should have encountered low-salinity groundwater if it were present. Our measurements do not exclude the possibility of springs acting as point sources of contaminants in BNP. But until such springs are located, sampled, and analyzed, they remain hypothetical. Based on this study, no regional groundwater contamination is evident in the BNP area sampled.

CONCLUSIONS

No significant evidence of contamination from groundwater into Biscayne Bay was found during this study. Low-salinity water was identified from nearshore wells and may indicate some leakage from the Biscayne Aquifer and/or surface-water intrusion into the rocks along western Biscayne Bay. Elevated nutrients in wells along the western shore indicate surface-water exchange is more likely than groundwater flow. Both ammonium and total soluble nitrogen were greater in nearshore wells than in the Biscayne Aquifer. Nitrite and nitrate were greater in Biscayne Aquifer water than in nearshore Biscayne Bay wells, indicating the possibility of nitrogen reduction along the shore. Lack of seasonal variation in groundwater salinity points to sluggish exchange with surface water. The groundwater beneath the shelf can be characterized as reduced seawater, modified by microbial respiration to remove oxygen and interaction with sediments and minerals in the host limestone. Analyses of 109 water samples collected from wells across the Florida shelf beneath BNP between August 2002 and March 2004 show no consistent evidence of wastewater contaminants occurring in groundwater beneath BNP. In addition, no significant leakage from the Floridan Aquifer was detected in the groundwater beneath BNP. At Black Point, the western edge of Biscayne Bay is influenced by surface water and perhaps by Biscayne Aquifer water, but the bulk of BNP is underlain by uncontaminated marine groundwater.

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Appendix A1 – A6

Hydrochemistry Tables

Appendix A-1. Hydrochemistry results for groundwater samples

Location ID	Location Name	Water Type	Well Depth (ft)	Latitude (N)	Longitude (W)	Sampling Round	Date of Collection	Time of Collection	Sp. Conductance (µS/cm)
G-3615	Waldin West	GW	70	25.500	-80.386	1	8/22/02	15:00	8920
G-3613	Coconut Palm	GW	70	25.537	-80.365	2	6/23/03	18:05	8450
G-3613	Coconut Palm	GW	70	25.537	-80.365	3	9/22/03	14:25	8480
G-3701	Coconut Palm-West	GW	70	25.537	-80.380	4	12/17/03	10:45	480
G-3613	Coconut Palm	GW	70	25.537	-80.365	5	3/31/04	11:30	7296
GW-BPI-1A	Black Point Inshore -1A	GW	18.5	25.526	-80.330	1	8/22/02	10:00	33800
GW-BPI-1A	Black Point Inshore -1A	GW	18.5	25.526	-80.330	2	6/24/03	17:50	32900
GW-BPI-1A	Black Point Inshore -1A	GW	18.5	25.526	-80.330	3	9/24/03	16:50	33000
GW-BPI-1A	Black Point Inshore -1A	GW	18.5	25.526	-80.330	4	12/17/03	14:35	32600
GW-BPI-1A	Black Point Inshore -1A	GW	18.5	25.526	-80.330	5	3/31/04	9:00	32091
GW-BKP-1A	Black Point	GW	22.5	25.526	-80.324	1	8/22/02	nd	nd
GW-BKP-1A	Black Point	GW	22.5	25.526	-80.324	2	6/25/03	16:00	49700
GW-BKP-1A	Black Point	GW	22.5	25.526	-80.324	3	9/24/03	15:35	48300
GW-BKP-1A	Black Point	GW	22.5	25.526	-80.324	4	12/17/03	13:20	49680
GW-BKP-1A	Black Point	GW	22.5	25.526	-80.324	5	3/29/04	12:40	49198
GW-MB-1A	Mid Bay -1A	GW	43	25.484	-80.267	1	8/22/02	15:45	54400
GW-MB-1A	Mid Bay -1A	GW	43	25.484	-80.267	2	6/24/03	12:45	53700
GW-MB-1A	Mid Bay -1A	GW	43	25.484	-80.267	3	9/24/03	13:00	49900
GW-MB-1A	Mid Bay -1A	GW	43	25.484	-80.267	4	12/15/03	16:00	49890
GW-MB-1A	Mid Bay -1A	GW	43	25.484	-80.267	5	3/29/04	14:40	53930
GW-MB-1B	Mid Bay -1B	GW	52	25.484	-80.267	1	8/22/02	16:30	54400
GW-MB-1B	Mid Bay -1B	GW	52	25.484	-80.267	2	6/24/03	13:20	53700
GW-MB-1B	Mid Bay -1B	GW	52	25.484	-80.267	3	9/24/03	13:45	54400
GW-MB-1B	Mid Bay -1B	GW	52	25.484	-80.267	4	12/15/03	17:00	53890
GW-MB-1B	Mid Bay -1B	GW	52	25.484	-80.267	5	3/29/04	16:00	54418
GW-MB-1C	Mid Bay -1C	GW	25	25.484	-80.267	1	8/22/02	17:00	54400
GW-MB-1C	Mid Bay -1C	GW	25	25.484	-80.267	2	6/24/03	14:10	53600
GW-MB-1C	Mid Bay -1C	GW	25	25.484	-80.267	3	9/24/03	14:00	50300
GW-MB-1C	Mid Bay -1C	GW	25	25.484	-80.267	4	12/15/03	17:20	51320
GW-MB-1C	Mid Bay -1C	GW	25	25.484	-80.267	5	3/29/04	17:30	53993
GW-BYP-1A	Billy's Point -1A	GW	23.5	25.428	-80.212	1	8/21/02	13:00	51900
GW-BYP-1A	Billy's Point -1A	GW	23.5	25.428	-80.212	2	6/24/03	10:20	53300
GW-BYP-1A	Billy's Point -1A	GW	23.5	25.428	-80.212	3	9/24/03	9:45	52800
GW-BYP-1A	Billy's Point -1A	GW	23.5	25.428	-80.212	4	12/16/03	13:00	53620
GW-BYP-1A	Billy's Point -1A	GW	23.5	25.428	-80.212	5	3/29/04	11:20	53773
GW-BYP-1B	Billy's Point -1B	GW	7.5	25.428	-80.212	1	8/21/02	14:00	53300
GW-BYP-1B	Billy's Point -1B	GW	7.5	25.428	-80.212	2	6/24/03	11:00	52700
GW-BYP-1B	Billy's Point -1B	GW	7.5	25.428	-80.212	3	9/24/03	10:15	53800
GW-BYP-1B	Billy's Point -1B	GW	7.5	25.428	-80.212	4	12/16/03	13:36	52940
GW-BYP-1B	Billy's Point -1B	GW	7.5	25.428	-80.212	5	3/29/04	11:50	53990

[nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Salinity (ppt)	Diss. Oxygen (mg/L)	Diss Oxy (%)	pH	Temp (ūC)	Redox (mV)	Li (ppb)	Be (ppb)	B (ppb)	Na (ppb)	Mg (ppb)	Al (ppb)	Si (ppb)	K (ppb)
G-3613	1	5.00	0.41	nd	6.82	25.30	nd	bmdl	bmdl	bmdl	432000	39900	bmdl	bmdl	13100
G-3613	2	4.70	1.74	3.3	6.94	24.00	120.0	7.00	bmdl	385	1400000	120000	bmdl	2180	27000
G-3613	3	4.70	0.22	2.7	6.46	24.70	nd	bmdl	bmdl	459	1520000	140000	bmdl	bmdl	31700
G-3613	4	0.23	0.23	2.8	7.37	24.72	-24.6	1.25	bmdl	110	22300	5090	12.70	7910	761
G-3613	5	4.01	0.61	7.7	7.03	24.49	-157.7	bmdl	bmdl	328	1140000	112000	bmdl	2870	25900
GW-BPI-1A	1	21.20	0.29	nd	6.83	27.20	nd	bmdl	bmdl	2360	4860000	624000	bmdl	bmdl	199000
GW-BPI-1A	2	20.70	0.79	10.0	6.89	27.30	-279.0	108.00	bmdl	1770	6400000	740000	3.39	5110	212000
GW-BPI-1A	3	20.50	nd	nd	7.88	nd	nd	100.00	bmdl	2760	7000000	805000	bmdl	7270	264000
GW-BPI-1A	4	20.36	0.24	3.3	6.88	24.98	-267.5	106.00	bmdl	2720	6470000	748000	27.80	4360	222000
GW-BPI-1A	5	20.00	0.28	3.9	6.84	24.94	-241.6	107.00	bmdl	2820	5290000	649000	bmdl	6330	237000
GW-BKP-1A	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GW-BKP-1A	2	32.70	0.26	3.4	7.32	28.60	-322.0	173.00	0.12	2690	10900000	1280000	2.75	1980	370000
GW-BKP-1A	3	31.40	nd	nd	7.75	nd	nd	156.00	bmdl	4990	11700000	1350000	bmdl	bmdl	450000
GW-BKP-1A	4	32.50	0.20	2.9	7.33	25.48	-290.0	185.00	bmdl	4540	9990000	1310000	31.10	1990	378000
GW-BKP-1A	5	32.14	2.10	0.1	7.29	25.54	-296.0	186.00	bmdl	4580	10400000	1260000	24.30	1920	416000
GW-MB-1A	1	36.00	1.71	nd	7.29	28.30	nd	147.00	bmdl	4160	9000000	1110000	bmdl	bmdl	346000
GW-MB-1A	2	35.60	0.13	1.6	7.32	27.00	-262.0	188.00	bmdl	2500	11500000	1320000	4.65	1900	398000
GW-MB-1A	3	32.60	nd	nd	7.87	nd	nd	170.00	bmdl	4540	11800000	1360000	bmdl	bmdl	446000
GW-MB-1A	4	32.70	0.41	nd	7.85	23.85	-137.1	182.00	bmdl	4210	10400000	1300000	33.90	746	382000
GW-MB-1A	5	35.66	0.18	2.7	7.44	24.69	-213.5	196.00	bmdl	4510	11500000	1400000	bmdl	bmdl	445000
GW-MB-1B	1	36.00	1.54	nd	7.20	27.90	nd	166.00	bmdl	4320	9410000	1160000	bmdl	6580	369000
GW-MB-1B	2	35.60	0.10	1.2	7.35	27.20	-237.0	194.00	bmdl	2740	11300000	1290000	7.53	1690	370000
GW-MB-1B	3	35.50	nd	nd	7.70	nd	nd	172.00	bmdl	4790	12800000	1510000	bmdl	bmdl	499000
GW-MB-1B	4	35.27	0.78	11.4	7.40	23.70	-125.4	190.00	bmdl	4650	11100000	1390000	34.20	2020	433000
GW-MB-1B	5	36.01	1.71	25.2	7.64	24.42	-0.4	197.00	bmdl	4590	11500000	1350000	bmdl	975	451000
GW-MB-1C	1	36.00	0.89	nd	7.31	28.10	nd	157.00	bmdl	4140	8730000	1090000	bmdl	bmdl	344000
GW-MB-1C	2	35.60	0.47	5.2	7.49	27.00	-261.0	189.00	0.12	2600	11500000	1330000	5.95	492	392000
GW-MB-1C	3	32.90	nd	nd	7.86	nd	nd	176.00	bmdl	4250	11900000	1340000	bmdl	bmdl	436000
GW-MB-1C	4	33.86	0.22	3.2	7.50	23.04	-194.9	196.00	bmdl	4530	11100000	1400000	30.90	1630	417000
GW-MB-1C	5	35.72	1.84	26.5	7.64	23.73	-112.9	174.00	bmdl	4520	11800000	1420000	bmdl	2050	452000
GW-BYP-1A	1	34.30	3.65	nd	7.89	29.20	nd	162.00	bmdl	4100	high	1050000	bmdl	bmdl	335000
GW-BYP-1A	2	35.30	0.30	3.8	7.39	27.60	-339.0	208.00	0.12	2700	11500000	1310000	2.58	723	380000
GW-BYP-1A	3	34.70	nd	nd	7.44	nd	nd	178.00	bmdl	4650	12200000	1420000	bmdl	bmdl	470000
GW-BYP-1A	4	35.42	0.22	3.2	7.38	24.45	-247.9	196.00	bmdl	4590	11000000	1430000	29.30	1470	421000
GW-BYP-1A	5	35.49	0.24	3.6	7.36	25.18	-251.8	187.00	bmdl	4380	11500000	1350000	bmdl	1420	456000
GW-BYP-1B	1	35.10	4.11	nd	7.63	30.80	nd	160.00	bmdl	4150	high	1080000	bmdl	bmdl	349000
GW-BYP-1B	2	34.90	0.10	1.3	7.12	27.60	-341.0	206.00	bmdl	2620	11600000	1310000	6.18	697	372000
GW-BYP-1B	3	35.40	nd	nd	7.51	nd	nd	194.00	bmdl	5390	12700000	1530000	bmdl	bmdl	505000
GW-BYP-1B	4	34.93	0.21	3.1	7.24	23.73	-289.6	191.00	bmdl	4360	10900000	1420000	34.30	712	426000
GW-BYP-1B	5	35.70	0.21	3.0	7.19	24.21	-301.3	199.00	bmdl	4520	11400000	1350000	bmdl	bmdl	453000

[bmdl, below method detection limit; high, too high for ICP/MS; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Ca (ppb)	Sc (ppb)	Ti (ppb)	V (ppb)	Cr (ppb)	Mn (ppb)	Fe (ppb)	Co (ppb)	Ni (ppb)	Cu (ppb)	Zn (ppb)	Ga (ppb)	Ge (ppb)	As (ppb)	Se (ppb)	Br (ppb)	Rb (ppb)
G-3613	1	158000	bmdl	bmdl	bmdl	54.70	bmdl	3120.00	0.60	bmdl	54.7	115.00	bmdl	bmdl	9.90	37.5	4740	6.9
G-3613	2	244000	bmdl	0.85	bmdl	bmdl	8.88	455.00	1.45	293.0	23.2	1.78	0.03	bmdl	6.82	24.7	9730	9.5
G-3613	3	283000	bmdl	bmdl	6.19	bmdl	11.00	643.00	1.34	684.0	76.7	bmdl	bmdl	bmdl	5.71	bmdl	9610	9.6
G-3613	4	58400	6.10	3.72	1.14	3.08	2.16	416.00	0.14	bmdl	0.4	0.83	0.02	bmdl	2.96	1.5	294	1.2
G-3613	5	251000	bmdl	2.41	3.35	14.80	17.10	2130.00	1.01	-3.0	3.7	bmdl	bmdl	bmdl	6.61	16.1	8580	12.2
GW-BPI-1A	1	311000	bmdl	bmdl	40.80	117.00	bmdl	1720.00	2.20	167.0	127.0	53.80	bmdl	bmdl	30.50	122.0	42900	73.4
GW-BPI-1A	2	314000	1.19	6.63	19.10	34.40	19.40	678.00	0.79	622.0	93.0	4.10	0.15	bmdl	34.50	109.0	57200	74.4
GW-BPI-1A	3	414000	bmdl	bmdl	31.60	81.50	21.20	882.00	0.67	1030.0	171.0	bmdl	bmdl	bmdl	27.10	73.8	44300	73.3
GW-BPI-1A	4	333000	bmdl	7.74	40.50	120.00	19.10	2310.00	1.09	34.9	25.8	12.80	0.17	bmdl	28.20	92.0	40200	66.0
GW-BPI-1A	5	375000	bmdl	5.55	34.30	93.10	20.00	1990.00	0.97	252.0	40.7	bmdl	0.14	bmdl	24.80	77.1	42300	75.2
GW-BKP-1A	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GW-BKP-1A	2	378000	bmdl	9.77	20.30	61.40	13.60	803.00	1.18	1230.0	165.0	6.29	0.18	bmdl	55.50	195.0	94100	122.0
GW-BKP-1A	3	515000	bmdl	bmdl	47.00	156.00	16.10	1060.00	0.99	-3.0	93.5	bmdl	bmdl	bmdl	46.00	117.0	71300	114.0
GW-BKP-1A	4	431000	bmdl	9.62	55.70	183.00	14.20	2900.00	1.64	58.1	37.5	10.10	0.14	bmdl	51.00	181.0	69500	113.0
GW-BKP-1A	5	498000	bmdl	8.07	47.10	175.00	24.00	2870.00	1.38	332.0	66.1	bmdl	0.10	bmdl	47.40	155.0	86300	133.0
GW-MB-1A	1	389000	bmdl	bmdl	43.10	146.00	bmdl	1810.00	2.60	248.0	303.0	167.00	bmdl	bmdl	50.10	179.0	77500	128.0
GW-MB-1A	2	384000	bmdl	16.10	20.70	68.00	19.60	1080.00	0.97	1320.0	199.0	6.66	0.14	bmdl	66.70	216.0	108000	143.0
GW-MB-1A	3	470000	bmdl	bmdl	42.30	145.00	bmdl	986.00	0.79	1380.0	264.0	bmdl	bmdl	bmdl	50.30	125.0	72200	114.0
GW-MB-1A	4	392000	bmdl	9.68	56.60	190.00	6.10	2840.00	1.87	91.3	39.5	17.60	0.15	bmdl	53.00	184.0	69800	111.0
GW-MB-1A	5	489000	bmdl	7.20	50.50	152.00	9.52	2370.00	1.84	401.0	71.5	bmdl	bmdl	bmdl	50.20	159.0	86300	134.0
GW-MB-1B	1	443000	bmdl	bmdl	43.90	176.00	bmdl	3330.00	2.90	228.0	235.0	370.00	bmdl	bmdl	52.40	172.0	80700	136.0
GW-MB-1B	2	382000	bmdl	10.60	31.60	94.00	19.90	1900.00	1.04	1110.0	170.0	6.17	0.13	bmdl	62.90	213.0	112000	138.0
GW-MB-1B	3	542000	bmdl	bmdl	44.10	162.00	23.60	1910.00	0.83	1900.0	397.0	bmdl	bmdl	bmdl	51.10	128.0	85100	125.0
GW-MB-1B	4	440000	bmdl	11.90	61.40	200.00	19.00	3690.00	1.70	102.0	44.9	9.21	0.14	bmdl	57.10	211.0	75500	118.0
GW-MB-1B	5	506000	bmdl	6.44	67.40	198.00	10.50	2560.00	1.98	313.0	62.5	8.90	bmdl	bmdl	47.90	157.0	88300	133.0
GW-MB-1C	1	375000	bmdl	bmdl	45.10	165.00	bmdl	1860.00	2.90	206.0	365.0	86.20	bmdl	bmdl	53.80	189.0	75200	126.0
GW-MB-1C	2	382000	bmdl	9.47	29.60	92.70	11.90	871.00	1.15	1320.0	192.0	7.03	0.12	bmdl	62.20	207.0	105000	133.0
GW-MB-1C	3	468000	bmdl	bmdl	40.90	138.00	bmdl	1100.00	0.98	1250.0	279.0	bmdl	bmdl	bmdl	47.90	120.0	71900	117.0
GW-MB-1C	4	417000	bmdl	11.00	59.10	201.00	13.20	2840.00	1.88	56.1	41.8	8.77	0.15	bmdl	55.00	206.0	74500	118.0
GW-MB-1C	5	494000	bmdl	7.88	46.20	155.00	15.70	2640.00	1.43	232.0	52.2	bmdl	0.14	bmdl	42.50	129.0	72500	122.0
GW-BYP-1A	1	367000	bmdl	bmdl	47.90	175.00	bmdl	2010.00	3.00	213.0	217.0	81.20	bmdl	bmdl	52.70	177.0	76600	123.0
GW-BYP-1A	2	374000	bmdl	10.60	21.80	68.90	9.94	925.00	1.15	1130.0	132.0	7.10	0.12	bmdl	63.70	212.0	110000	136.0
GW-BYP-1A	3	507000	bmdl	53.70	43.70	148.00	bmdl	3740.00	1.09	1170.0	276.0	bmdl	bmdl	bmdl	61.40	123.0	74800	122.0
GW-BYP-1A	4	433000	bmdl	13.90	57.90	201.00	9.13	3050.00	2.04	91.8	43.5	12.50	0.11	bmdl	58.30	203.0	74800	123.0
GW-BYP-1A	5	498000	bmdl	8.36	50.40	173.00	10.70	2430.00	1.48	358.0	67.7	bmdl	0.11	bmdl	47.90	155.0	89000	134.0
GW-BYP-1B	1	386000	bmdl	bmdl	46.10	162.00	bmdl	1840.00	2.90	237.0	233.0	123.00	bmdl	bmdl	56.20	155.0	76900	130.0
GW-BYP-1B	2	394000	bmdl	10.40	23.40	73.80	2.85	904.00	1.17	1030.0	152.0	6.49	0.09	bmdl	63.10	213.0	109000	135.0
GW-BYP-1B	3	545000	bmdl	bmdl	50.00	169.00	bmdl	1230.00	1.36	238.0	147.0	bmdl	bmdl	bmdl	53.10	135.0	88800	127.0
GW-BYP-1B	4	446000	bmdl	11.10	51.60	188.00	3.44	3050.00	1.80	74.9	41.6	8.72	bmdl	bmdl	54.00	199.0	74600	122.0
GW-BYP-1B	5	518000	bmdl	6.80	47.80	174.00	3.16	2540.00	1.46	414.0	71.7	bmdl	bmdl	bmdl	48.10	150.0	88100	135.0

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Sr (ppb)	Y (ppb)	Zr (ppb)	Nb (ppb)	Mo (ppb)	Ru (ppb)	Pd (ppb)	Ag (ppb)	Cd (ppb)	In (ppb)	Sn (ppb)	Sb (ppb)	Te (ppb)	I (ppb)	Cs (ppb)	Ba (ppb)
G-3613	1	3430	bmdl	bmdl	bmdl	bmdl	bmdl	2.40	bmdl	bmdl	bmdl	bmdl	bmdl	1.20	bmdl	bmdl	55.50
G-3613	2	4450	0.01	bmdl	0.01	0.77	0.03	0.17	bmdl	bmdl	bmdl	bmdl	0.05	0.02	48.20	0.17	82.20
G-3613	3	3610	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	81.70
G-3613	4	1980	0.02	bmdl	bmdl	1.74	bmdl	0.01	bmdl	bmdl	bmdl	0.15	0.14	bmdl	44.30	0.01	25.80
G-3613	5	3470	bmdl	bmdl	bmdl	1.09	bmdl	0.39	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	582.00	0.31	82.80
GW-BPI-1A	1	5600	bmdl	bmdl	bmdl	bmdl	bmdl	5.50	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	26.60
GW-BPI-1A	2	7550	0.03	0.32	0.02	0.32	0.45	0.27	bmdl	bmdl	0.00	bmdl	0.05	0.24	45.00	0.20	26.30
GW-BPI-1A	3	5930	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	24.60
GW-BPI-1A	4	5280	0.06	0.19	bmdl	bmdl	0.31	1.07	bmdl	bmdl	0.07	bmdl	bmdl	bmdl	54.50	0.15	21.80
GW-BPI-1A	5	4700	0.05	0.18	bmdl	bmdl	0.13	1.05	bmdl	bmdl	bmdl	bmdl	bmdl	0.11	526.00	0.17	25.60
GW-BKP-1A	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GW-BKP-1A	2	10700	0.03	0.02	0.01	0.34	0.52	bmdl	bmdl	0.03	0.01	bmdl	0.06	0.40	54.30	0.33	33.70
GW-BKP-1A	3	8830	bmdl	bmdl	bmdl	bmdl	bmdl	1.17	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.32	30.80
GW-BKP-1A	4	8460	0.09	bmdl	bmdl	bmdl	0.63	2.51	bmdl	bmdl	0.14	bmdl	bmdl	0.92	62.90	0.32	31.50
GW-BKP-1A	5	8120	0.04	bmdl	bmdl	1.60	0.59	1.47	bmdl	bmdl	0.01	bmdl	0.41	0.13	574.00	0.35	28.40
GW-MB-1A	1	8560	bmdl	bmdl	bmdl	bmdl	bmdl	3.80	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.30	32.10
GW-MB-1A	2	12900	0.03	0.02	0.02	0.84	0.54	0.80	bmdl	0.04	0.01	bmdl	0.08	0.68	51.40	0.35	33.10
GW-MB-1A	3	8130	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.27	bmdl
GW-MB-1A	4	7890	0.06	bmdl	bmdl	3.19	0.87	1.34	bmdl	bmdl	0.14	bmdl	0.36	bmdl	47.10	0.27	13.00
GW-MB-1A	5	8400	0.04	bmdl	bmdl	8.20	0.56	1.61	bmdl	bmdl	bmdl	bmdl	0.25	0.18	550.00	0.35	15.00
GW-MB-1B	1	8850	bmdl	bmdl	bmdl	bmdl	bmdl	3.10	bmdl	bmdl	bmdl	bmdl	bmdl	1.10	bmdl	0.30	45.60
GW-MB-1B	2	12100	0.03	0.03	0.02	1.49	1.27	0.07	bmdl	0.05	0.01	0.16	0.09	0.12	46.00	0.33	32.50
GW-MB-1B	3	9290	bmdl	bmdl	bmdl	bmdl	bmdl	1.45	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.25	29.00
GW-MB-1B	4	8930	0.07	bmdl	bmdl	2.09	0.87	2.67	bmdl	bmdl	0.14	bmdl	bmdl	1.13	62.80	0.29	26.80
GW-MB-1B	5	8190	0.06	bmdl	bmdl	4.82	0.58	1.31	bmdl	bmdl	0.01	bmdl	0.15	0.38	557.00	0.33	22.00
GW-MB-1C	1	8220	bmdl	bmdl	bmdl	bmdl	bmdl	5.40	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.20	32.50
GW-MB-1C	2	11800	0.02	0.02	0.01	1.54	1.50	0.93	bmdl	0.05	0.01	bmdl	0.07	0.49	50.00	0.36	28.30
GW-MB-1C	3	7960	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.27	bmdl
GW-MB-1C	4	8620	0.08	bmdl	bmdl	bmdl	0.70	1.07	bmdl	bmdl	0.12	bmdl	bmdl	0.27	61.70	0.28	23.90
GW-MB-1C	5	8230	0.05	bmdl	bmdl	bmdl	0.34	1.30	bmdl	bmdl	0.01	bmdl	bmdl	0.17	551.00	0.35	35.30
GW-BYP-1A	1	7920	bmdl	bmdl	bmdl	bmdl	1.10	4.60	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.30	12.30
GW-BYP-1A	2	11900	0.03	0.01	0.01	3.16	1.48	0.51	bmdl	0.04	0.01	bmdl	0.06	0.75	38.70	0.32	10.90
GW-BYP-1A	3	8680	bmdl	bmdl	bmdl	bmdl	bmdl	1.28	bmdl	bmdl	0.30	bmdl	bmdl	bmdl	bmdl	0.30	15.10
GW-BYP-1A	4	8660	0.10	bmdl	bmdl	2.80	1.02	0.83	bmdl	bmdl	0.16	bmdl	bmdl	0.24	60.00	0.30	10.60
GW-BYP-1A	5	8190	0.04	bmdl	bmdl	4.31	0.79	1.75	bmdl	bmdl	bmdl	bmdl	bmdl	0.14	540.00	0.34	10.60
GW-BYP-1B	1	8010	bmdl	bmdl	bmdl	bmdl	1.40	5.40	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.30	15.70
GW-BYP-1B	2	11800	0.03	0.02	0.02	1.35	1.20	0.03	bmdl	0.05	0.01	bmdl	0.08	0.48	42.00	0.33	9.86
GW-BYP-1B	3	9100	bmdl	bmdl	bmdl	bmdl	bmdl	1.35	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.27	bmdl
GW-BYP-1B	4	8540	0.09	bmdl	bmdl	3.46	0.78	2.68	bmdl	bmdl	0.15	bmdl	bmdl	0.24	51.70	0.26	7.49
GW-BYP-1B	5	7560	0.04	bmdl	bmdl	1.36	0.55	1.30	bmdl	bmdl	0.01	bmdl	bmdl	0.28	564.00	0.32	8.75

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	La (ppb)	Ce (ppb)	Pr (ppb)	Nd (ppb)	Sm (ppb)	Eu (ppb)	Gd (ppb)	Tb (ppb)	Dy (ppb)	Ho (ppb)	Er (ppb)	Tm (ppb)	Yb (ppb)	Lu (ppb)	Hf (ppb)
G-3613	1	bmdl	bmdl	bmdl	bmdl	bmdl	0.100	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
G-3613	2	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
G-3613	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
G-3613	4	0.006	0.010	0.002	bmdl	bmdl	0.003	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.006	bmdl
G-3613	5	0.014	0.022	bmdl	bmdl	bmdl	0.018	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BPI-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BPI-1A	2	0.004	bmdl	0.005	0.007	bmdl	0.001	0.002	0.003	bmdl	0.016	0.006	bmdl	0.002	bmdl	bmdl
GW-BPI-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BPI-1A	4	0.048	0.084	0.021	bmdl	bmdl	bmdl	0.030	0.016	0.012	bmdl	bmdl	bmdl	bmdl	0.044	bmdl
GW-BPI-1A	5	0.015	0.025	bmdl	0.051	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BKP-1A	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GW-BKP-1A	2	0.030	bmdl	0.003	bmdl	bmdl	bmdl	bmdl	0.008	bmdl	0.034	0.002	bmdl	0.003	bmdl	0.003
GW-BKP-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BKP-1A	4	0.047	0.101	0.013	0.058	bmdl	bmdl	0.021	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.059	bmdl
GW-BKP-1A	5	0.025	0.022	0.015	bmdl	bmdl	bmdl	bmdl	0.012	bmdl	0.019	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1A	2	0.019	0.008	0.010	0.015	0.003	0.001	0.004	0.005	0.008	0.020	0.002	bmdl	0.002	bmdl	0.007
GW-MB-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1A	4	0.061	0.092	0.015	0.086	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.052	bmdl
GW-MB-1A	5	0.019	bmdl	0.017	bmdl	0.029	bmdl	bmdl	bmdl	bmdl	0.012	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1B	2	0.010	bmdl	0.002	bmdl	bmdl	bmdl	bmdl	0.006	bmdl	0.044	bmdl	bmdl	0.001	bmdl	bmdl
GW-MB-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1B	4	0.052	0.086	0.024	0.047	bmdl	bmdl	bmdl	bmdl	bmdl	0.011	bmdl	bmdl	0.012	0.058	0.022
GW-MB-1B	5	0.014	0.030	0.014	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.014	bmdl	bmdl	0.015	bmdl	bmdl
GW-MB-1C	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1C	2	0.011	bmdl	0.024	bmdl	0.006	0.003	bmdl	0.002	0.004	0.024	bmdl	bmdl	bmdl	bmdl	0.008
GW-MB-1C	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-MB-1C	4	0.051	0.099	0.018	bmdl	bmdl	0.011	bmdl	0.011	0.013	bmdl	bmdl	bmdl	bmdl	0.066	bmdl
GW-MB-1C	5	0.026	0.034	0.024	bmdl	0.028	bmdl	bmdl	bmdl	0.012	0.018	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BYP-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BYP-1A	2	0.062	0.002	0.012	0.009	bmdl	bmdl	0.009	0.006	0.011	0.029	bmdl	bmdl	bmdl	bmdl	0.007
GW-BYP-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.215	bmdl	bmdl
GW-BYP-1A	4	0.049	0.084	0.018	bmdl	bmdl	bmdl	bmdl	0.012	bmdl	0.012	bmdl	bmdl	bmdl	0.069	0.022
GW-BYP-1A	5	0.026	0.025	0.010	bmdl	bmdl	bmdl	bmdl	bmdl	0.012	bmdl	bmdl	bmdl	0.014	bmdl	bmdl
GW-BYP-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BYP-1B	2	0.034	0.011	0.028	bmdl	0.010	bmdl	bmdl	0.001	0.002	0.022	bmdl	bmdl	0.002	bmdl	0.010
GW-BYP-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-BYP-1B	4	0.043	0.086	0.011	0.058	bmdl	bmdl	bmdl	0.016	bmdl	bmdl	0.014	bmdl	bmdl	0.058	bmdl
GW-BYP-1B	5	0.030	0.031	0.017	bmdl	bmdl	bmdl	bmdl	0.023	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Ta (ppb)	W (ppb)	Re (ppb)	Os (ppb)	Pt (ppb)	Au (ppb)	Hg (ppb)	Tl (ppb)	Pb (ppb)	Bi (ppb)	Th (ppb)	U (ppb)	DOC (mg/L)	TOC (mg/L)	NO2- (mg/L)
G-3613	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	14.300	1.300	bmdl	1.900	2.70	1.10	0.082
G-3613	2	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.182	0.198	bmdl	bmdl	4.550	1.40	1.30	0.062
G-3613	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	4.580	1.40	nd	0.119
G-3613	4	bmdl	bmdl	bmdl	bmdl	bmdl	0.003	bmdl	bmdl	bmdl	bmdl	bmdl	6.300	0.45	nd	0.000
G-3613	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.650	1.76	nd	0.133
GW-BPI-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	15.900	5.500	bmdl	bmdl	9.20	9.10	0.001
GW-BPI-1A	2	bmdl	0.079	bmdl	bmdl	bmdl	0.004	bmdl	bmdl	bmdl	bmdl	0.003	0.087	9.40	9.40	0.002
GW-BPI-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.323	1.60	nd	0.001
GW-BPI-1A	4	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	3.300	0.965	0.068	0.146	10.00	nd	0.001
GW-BPI-1A	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.121	10.03	nd	0.001
GW-BKP-1A	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GW-BKP-1A	2	bmdl	0.900	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.001	0.154	2.20	2.40	0.003
GW-BKP-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.426	2.50	nd	0.001
GW-BKP-1A	4	bmdl	0.328	bmdl	bmdl	bmdl	0.035	bmdl	bmdl	1.310	0.285	0.068	0.181	2.90	nd	0.001
GW-BKP-1A	5	bmdl	2.080	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.140	bmdl	bmdl	1.040	2.16	nd	0.003
GW-MB-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	15.200	1.700	bmdl	0.100	1.10	1.10	0.003
GW-MB-1A	2	0.002	0.069	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.001	0.117	1.10	1.00	0.003
GW-MB-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.880	2.30	nd	0.003
GW-MB-1A	4	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.040	0.132	0.082	1.680	1.80	nd	0.029
GW-MB-1A	5	bmdl	1.400	bmdl	bmdl	bmdl	0.027	bmdl	bmdl	bmdl	bmdl	bmdl	7.990	1.24	nd	0.004
GW-MB-1B	1	bmdl	7.100	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.100	bmdl	1.200	1.10	1.10	0.002
GW-MB-1B	2	bmdl	4.790	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.004	0.929	1.20	1.20	0.004
GW-MB-1B	3	bmdl	2.960	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.250	1.30	nd	0.001
GW-MB-1B	4	bmdl	1.100	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.620	bmdl	0.076	0.889	1.40	nd	0.002
GW-MB-1B	5	bmdl	0.478	bmdl	bmdl	bmdl	0.021	bmdl	bmdl	1.280	bmdl	bmdl	3.970	1.26	nd	0.024
GW-MB-1C	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	58.900	1.200	bmdl	0.600	1.10	1.00	0.002
GW-MB-1C	2	bmdl	0.318	bmdl	bmdl	bmdl	0.007	bmdl	bmdl	bmdl	bmdl	0.003	0.601	1.00	1.20	0.004
GW-MB-1C	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	3.230	2.20	nd	0.003
GW-MB-1C	4	bmdl	bmdl	bmdl	bmdl	bmdl	0.156	bmdl	bmdl	bmdl	bmdl	0.087	0.343	1.30	nd	0.002
GW-MB-1C	5	bmdl	0.604	bmdl	bmdl	bmdl	0.037	bmdl	bmdl	bmdl	bmdl	0.013	0.225	0.92	nd	0.004
GW-BYP-1A	1	bmdl	2.300	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.400	bmdl	2.200	2.60	2.70	0.003
GW-BYP-1A	2	bmdl	0.190	bmdl	bmdl	bmdl	0.005	bmdl	bmdl	bmdl	bmdl	0.004	0.609	1.10	1.40	0.003
GW-BYP-1A	3	bmdl	bmdl	0.135	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	26.500	2.10	nd	0.001
GW-BYP-1A	4	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.118	0.124	0.584	1.30	nd	0.001
GW-BYP-1A	5	bmdl	bmdl	bmdl	bmdl	bmdl	0.026	bmdl	bmdl	1.040	bmdl	bmdl	0.484	1.17	nd	0.004
GW-BYP-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.700	bmdl	2.100	1.90	1.90	0.002
GW-BYP-1B	2	bmdl	0.446	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.002	2.160	1.50	1.50	0.003
GW-BYP-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.710	2.30	nd	0.002
GW-BYP-1B	4	bmdl	bmdl	0.012	bmdl	bmdl	0.044	bmdl	bmdl	1.160	0.192	0.077	1.190	1.60	nd	0.001
GW-BYP-1B	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.120	bmdl	bmdl	1.500	1.45	nd	0.003

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	NO3- (mg/L)	NH4+ (mg/L)	DIN (mg/L)	TSN (mg/L)	TN (mg/L)	SRP (mg/L)	TSP (mg/L)	TP (mg/L)	Sol. SiO2 (mg/L)	SO4 (mM)
G-3613	1	0.836	0.013	0.931	1.011	1.074	0.070	0.093	0.000	4.530	1.7
G-3613	2	1.287	0.067	1.415	0.536	nd	0.009	0.011	nd	4.731	nd
G-3613	3	0.808	0.020	0.946	0.946	nd	0.009	0.016	nd	3.775	nd
G-3613	4	0.103	0.032	0.135	0.135	nd	0.108	0.108	nd	17.076	nd
G-3613	5	0.634	0.000	0.767	0.767	nd	0.071	0.071	nd	2.636	nd
GW-BPI-1A	1	0.000	0.157	0.158	0.578	0.559	0.033	0.031	0.032	11.200	17.1
GW-BPI-1A	2	0.000	0.250	0.252	1.118	nd	0.029	0.035	nd	10.646	nd
GW-BPI-1A	3	0.003	0.261	0.265	0.557	nd	0.033	0.043	nd	9.575	nd
GW-BPI-1A	4	0.003	0.261	0.265	0.640	nd	0.040	0.040	nd	10.211	nd
GW-BPI-1A	5	0.001	0.247	0.249	0.699	nd	0.044	0.044	nd	11.191	nd
GW-BKP-1A	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
GW-BKP-1A	2	0.000	1.115	1.118	0.354	nd	0.014	0.021	nd	4.005	nd
GW-BKP-1A	3	0.044	1.022	1.067	1.827	nd	0.019	0.065	nd	3.294	nd
GW-BKP-1A	4	0.004	1.292	1.297	1.297	nd	0.026	0.026	nd	4.010	nd
GW-BKP-1A	5	0.001	0.989	0.993	1.174	nd	0.037	0.037	nd	4.585	nd
GW-MB-1A	1	0.000	0.325	0.328	0.358	0.365	0.023	0.022	0.022	4.400	28.7
GW-MB-1A	2	0.000	0.351	0.354	0.347	nd	0.020	0.028	nd	4.094	nd
GW-MB-1A	3	0.038	0.028	0.069	0.127	nd	0.035	0.035	nd	0.000	nd
GW-MB-1A	4	0.097	0.146	0.272	0.281	nd	0.031	0.031	nd	1.469	nd
GW-MB-1A	5	0.000	0.735	0.739	0.873	nd	0.062	0.062	nd	3.375	nd
GW-MB-1B	1	0.000	0.384	0.386	0.426	0.430	0.021	0.023	0.029	4.760	29.7
GW-MB-1B	2	0.000	0.343	0.347	0.397	nd	0.018	0.027	nd	4.434	nd
GW-MB-1B	3	0.004	0.410	0.415	0.569	nd	0.004	0.020	nd	0.000	nd
GW-MB-1B	4	0.005	0.381	0.388	0.395	nd	0.028	0.028	nd	3.693	nd
GW-MB-1B	5	0.033	0.105	0.162	0.458	nd	0.014	0.015	nd	0.997	nd
GW-MB-1C	1	0.000	0.335	0.337	0.369	0.370	0.012	0.012	0.012	3.660	29.5
GW-MB-1C	2	0.000	0.393	0.397	0.246	nd	0.016	0.022	nd	3.267	nd
GW-MB-1C	3	0.037	0.027	0.067	0.650	nd	0.000	0.007	nd	0.000	nd
GW-MB-1C	4	0.003	0.394	0.399	0.409	nd	0.031	0.031	nd	3.083	nd
GW-MB-1C	5	0.004	0.252	0.260	0.394	nd	0.021	0.023	nd	2.552	nd
GW-BYP-1A	1	0.019	0.022	0.044	0.186	0.219	0.005	0.005	0.008	0.240	29.1
GW-BYP-1A	2	0.000	0.243	0.246	0.210	nd	0.011	0.018	nd	2.408	nd
GW-BYP-1A	3	0.029	1.023	1.053	1.157	nd	0.130	0.141	nd	0.000	nd
GW-BYP-1A	4	0.002	0.357	0.360	0.360	nd	0.038	0.038	nd	2.620	nd
GW-BYP-1A	5	0.000	0.267	0.271	0.305	nd	0.028	0.028	nd	3.051	nd
GW-BYP-1B	1	0.008	0.056	0.066	0.178	0.189	0.004	0.008	0.008	0.550	28.4
GW-BYP-1B	2	0.000	0.207	0.210	0.207	nd	0.003	0.009	nd	1.119	nd
GW-BYP-1B	3	0.022	0.112	0.136	0.136	nd	0.022	0.022	nd	0.000	nd
GW-BYP-1B	4	0.003	0.365	0.369	0.387	nd	0.014	0.014	nd	0.650	nd
GW-BYP-1B	5	0.000	0.176	0.179	0.291	nd	0.031	0.031	nd	1.773	nd

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Location Name	Water Type	Well Depth (ft)	Latitude (N)	Longitude (W)	Sampling Round	Date of Collection	Time of Collection	Sp. Conductance (µS/cm)
GW-PP-1A	Petrel Point -1A	GW	43.5	25.415	-80.204	1	8/20/1998	10:50	52100
GW-PP-1A	Petrel Point -1A	GW	43.5	25.415	-80.204	2	6/24/1999	9:35	51500
GW-PP-1A	Petrel Point -1A	GW	43.5	25.415	-80.204	3	9/22/1999	15:25	50500
GW-PP-1A	Petrel Point -1A	GW	43.5	25.415	-80.204	4	12/15/1999	10:36	51250
GW-PP-1A	Petrel Point -1A	GW	43.5	25.415	-80.204	5	3/28/2000	9:25	51526
GW-PP-1B	Petrel Point -1B	GW	22.5	25.415	-80.204	1	8/20/1998	11:15	49300
GW-PP-1B	Petrel Point -1B	GW	22.5	25.415	-80.204	2	6/24/1999	10:25	49600
GW-PP-1B	Petrel Point -1B	GW	22.5	25.415	-80.204	3	9/22/1999	16:15	48700
GW-PP-1B	Petrel Point -1B	GW	22.5	25.415	-80.204	4	12/15/1999	11:35	48940
GW-PP-1B	Petrel Point -1B	GW	22.5	25.415	-80.204	5	3/28/2000	9:55	48925
GW-AR-1A	Alina's Reef -1A	GW	69	25.386	-80.163	1	8/19/1998	14:10	54377
GW-AR-1A	Alina's Reef -1A	GW	69	25.386	-80.163	2	6/25/1999	9:55	53800
GW-AR-1A	Alina's Reef -1A	GW	69	25.386	-80.163	3	9/22/1999	12:30	53600
GW-AR-1A	Alina's Reef -1A	GW	69	25.386	-80.163	4	1/13/2000	14:35	53209
GW-AR-1A	Alina's Reef -1A	GW	69	25.386	-80.163	5	3/29/2000	9:40	53825
GW-AR-1B	Alina's Reef -1B	GW	41	25.386	-80.163	1	8/19/1998	15:10	54078
GW-AR-1B	Alina's Reef -1B	GW	41	25.386	-80.163	2	6/25/1999	10:50	53700
GW-AR-1B	Alina's Reef -1B	GW	41	25.386	-80.163	3	9/22/1999	13:00	53300
GW-AR-1B	Alina's Reef -1B	GW	41	25.386	-80.163	4	1/13/2000	15:10	52951
GW-AR-1B	Alina's Reef -1B	GW	41	25.386	-80.163	5	3/29/2000	10:10	53620
GW-AR-1C	Alina's Reef -1C	GW	21	25.386	-80.163	1	8/19/1998	16:10	54746
GW-AR-1C	Alina's Reef -1C	GW	21	25.386	-80.163	2	6/25/1999	11:35	53700
GW-AR-1C	Alina's Reef -1C	GW	21	25.386	-80.163	3	9/22/1999	13:40	53000
GW-AR-1C	Alina's Reef -1C	GW	21	25.386	-80.163	4	1/13/2000	15:45	53071
GW-AR-1C	Alina's Reef -1C	GW	21	25.386	-80.163	5	3/29/2000	9:00	53880
GW-PR-1A	Pacific Reef -1A	GW	51	25.371	-80.142	1	8/19/1998	11:15	52833
GW-PR-1A	Pacific Reef -1A	GW	51	25.371	-80.142	2	6/24/1999	12:15	52800
GW-PR-1A	Pacific Reef -1A	GW	51	25.371	-80.142	3	9/22/1999	10:45	52700
GW-PR-1A	Pacific Reef -1A	GW	51	25.371	-80.142	4	1/13/2000	11:25	52620
GW-PR-1A	Pacific Reef -1A	GW	51	25.371	-80.142	5	3/29/2000	12:25	52869
GW-PR-1B	Pacific Reef -1B	GW	20	25.371	-80.142	1	8/19/1998	12:20	54414
GW-PR-1B	Pacific Reef -1B	GW	20	25.371	-80.142	2	6/24/1999	12:50	53900
GW-PR-1B	Pacific Reef -1B	GW	20	25.371	-80.142	3	9/22/1999	11:15	53400
GW-PR-1B	Pacific Reef -1B	GW	20	25.371	-80.142	4	1/13/2000	12:05	53422
GW-PR-1B	Pacific Reef -1B	GW	20	25.371	-80.142	5	3/29/2000	12:45	53784

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Salinity (ppt)	Diss. Oxygen (mg/L)	Diss Oxy (%)	pH	Temp (ûC)	Redox (mV)	Li (ppb)	Be (ppb)	B (ppb)	Na (ppb)	Mg (ppb)	Al (ppb)	Si (ppb)	K (ppb)
GW-PP-1A	1	34.30	1.70	nd	7.21	27.30	nd	156.00	bmdl	4190	8240000	1050000	bmdl	bmdl	329000
GW-PP-1A	2	33.90	0.23	2.9	7.11	26.30	-254.0	196.00	0.17	2710	11100000	1290000	2.48	167	385000
GW-PP-1A	3	33.40	0.71	10.7	7.15	30.00	nd	177.00	bmdl	4470	12300000	1360000	bmdl	bmdl	456000
GW-PP-1A	4	33.68	0.58	8.4	7.20	23.66	-143.0	181.00	bmdl	4370	10400000	1360000	27.80	1460	410000
GW-PP-1A	5	33.89	0.43	6.2	7.13	24.30	-186.9	182.00	bmdl	4440	10600000	1270000	bmdl	4770	430000
GW-PP-1B	1	32.20	1.75	nd	6.87	27.30	nd	174.00	bmdl	3960	high	1000000	bmdl	bmdl	316000
GW-PP-1B	2	32.50	0.18	2.2	7.05	26.50	-110.0	187.00	bmdl	2630	10800000	1220000	2.59	bmdl	332000
GW-PP-1B	3	32.00	0.54	7.4	7.09	29.60	nd	174.00	bmdl	4190	11600000	1280000	bmdl	bmdl	431000
GW-PP-1B	4	31.99	0.54	7.7	7.04	23.51	-134.0	179.00	bmdl	4140	10400000	1280000	29.20	1100	375000
GW-PP-1B	5	31.96	0.23	3.3	6.95	24.41	-251.3	179.00	bmdl	4290	10000000	1210000	bmdl	1260	409000
GW-AR-1A	1	36.10	0.17	nd	7.20	27.63	nd	158.00	bmdl	4080	high	1040000	221.00	bmdl	330000
GW-AR-1A	2	35.70	0.17	2.2	7.19	27.40	-309.0	205.00	0.12	3640	11700000	1340000	6.34	1510	372000
GW-AR-1A	3	35.60	0.46	6.2	7.31	28.50	nd	206.00	bmdl	5100	13500000	1540000	bmdl	bmdl	508000
GW-AR-1A	4	35.11	0.30	4.5	7.20	24.69	-260.9	194.00	bmdl	4510	11100000	1370000	bmdl	2030	472000
GW-AR-1A	5	35.57	0.24	3.6	7.15	24.93	-279.6	195.00	bmdl	4370	11400000	1350000	bmdl	2030	439000
GW-AR-1B	1	35.80	0.15	nd	7.61	27.95	nd	162.00	bmdl	4350	high	1150000	bmdl	bmdl	359000
GW-AR-1B	2	35.60	0.08	1.1	7.62	27.70	-275.0	204.00	0.11	2660	11800000	1360000	16.40	bmdl	418000
GW-AR-1B	3	35.40	0.31	4.6	7.68	28.50	nd	191.00	bmdl	4750	12900000	1510000	bmdl	bmdl	492000
GW-AR-1B	4	34.92	0.13	1.9	7.44	24.83	-259.9	182.00	bmdl	4360	11000000	1360000	20.50	1460	449000
GW-AR-1B	5	35.41	0.20	2.9	7.39	25.09	-274.5	206.00	bmdl	4530	11100000	1360000	20.70	1730	446000
GW-AR-1C	1	36.30	0.34	nd	7.76	29.33	nd	161.00	bmdl	4550	9300000	1190000	bmdl	bmdl	361000
GW-AR-1C	2	35.70	0.30	3.9	7.72	28.20	-164.0	211.00	0.11	3050	11700000	1340000	11.40	bmdl	340000
GW-AR-1C	3	35.20	0.41	5.4	7.84	29.30	nd	187.00	bmdl	4480	12700000	1340000	bmdl	bmdl	451000
GW-AR-1C	4	35.03	0.32	4.6	7.64	23.55	-113.9	178.00	bmdl	4080	11100000	1370000	bmdl	bmdl	449000
GW-AR-1C	5	35.64	0.69	10.1	7.68	23.90	-12.4	200.00	bmdl	4560	11500000	1350000	bmdl	bmdl	446000
GW-PR-1A	1	34.90	0.13	nd	nd	28.93	nd	170.00	bmdl	4380	9300000	1110000	bmdl	bmdl	354000
GW-PR-1A	2	35.00	0.19	2.5	7.39	27.70	-283.0	205.00	0.13	2630	11400000	1300000	5.31	1660	382000
GW-PR-1A	3	35.00	0.35	5.2	7.53	28.50	nd	187.00	bmdl	4690	12900000	1410000	bmdl	bmdl	478000
GW-PR-1A	4	34.67	0.16	2.4	7.30	25.14	-263.4	186.00	bmdl	4350	10000000	1350000	bmdl	2150	460000
GW-PR-1A	5	34.84	0.29	4.4	7.34	25.83	-249.0	199.00	bmdl	4660	11300000	1360000	bmdl	2110	454000
GW-PR-1B	1	36.10	0.08	nd	nd	28.72	nd	161.00	bmdl	4060	8590000	1040000	218.00	5330	344000
GW-PR-1B	2	35.80	0.18	2.4	7.57	27.80	-319.0	213.00	bmdl	2830	11600000	1330000	16.60	bmdl	394000
GW-PR-1B	3	35.50	0.27	3.9	7.64	28.80	nd	198.00	bmdl	4960	13300000	1440000	bmdl	bmdl	499000
GW-PR-1B	4	35.26	0.12	1.8	7.53	25.08	-248.0	183.00	bmdl	4250	11100000	1370000	21.00	bmdl	445000
GW-PR-1B	5	35.52	0.26	3.9	7.54	25.58	-283.0	198.00	bmdl	4420	11700000	1380000	26.30	bmdl	460000

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Ca (ppb)	Sc (ppb)	Ti (ppb)	V (ppb)	Cr (ppb)	Mn (ppb)	Fe (ppb)	Co (ppb)	Ni (ppb)	Cu (ppb)	Zn (ppb)	Ga (ppb)	Ge (ppb)	As (ppb)	Se (ppb)	Br (ppb)	Rb (ppb)
GW-PP-1A	1	386000	bmdl	bmdl	48.00	159.00	bmdl	3180.00	3.50	220.0	206.0	55.00	bmdl	bmdl	66.40	147.0	72600	118.0
GW-PP-1A	2	398000	bmdl	9.87	22.90	69.50	26.90	932.00	0.79	1310.0	163.0	6.40	0.11	bmdl	59.80	204.0	101000	129.0
GW-PP-1A	3	533000	bmdl	bmdl	41.90	145.00	38.80	1090.00	1.25	1620.0	325.0	bmdl	bmdl	bmdl	50.90	141.0	73500	121.0
GW-PP-1A	4	458000	bmdl	10.80	52.50	179.00	25.90	5840.00	1.65	51.1	38.6	10.00	bmdl	bmdl	59.70	194.0	70900	117.0
GW-PP-1A	5	502000	bmdl	10.30	51.90	169.00	31.00	3620.00	1.52	341.0	64.2	bmdl	bmdl	bmdl	54.40	146.0	82200	126.0
GW-PP-1B	1	391000	bmdl	bmdl	41.40	150.00	22.60	1720.00	2.30	251.0	190.0	96.70	bmdl	bmdl	49.50	148.0	68300	112.0
GW-PP-1B	2	385000	bmdl	10.60	25.60	74.70	42.10	941.00	1.07	1190.0	185.0	6.67	0.12	bmdl	59.60	198.0	93100	123.0
GW-PP-1B	3	511000	bmdl	bmdl	39.40	133.00	68.60	1250.00	0.97	1340.0	282.0	bmdl	bmdl	bmdl	45.00	117.0	70300	114.0
GW-PP-1B	4	434000	bmdl	11.10	55.40	163.00	44.20	3150.00	1.54	-3.0	32.0	9.59	bmdl	bmdl	51.80	188.0	67000	111.0
GW-PP-1B	5	496000	bmdl	5.20	44.50	146.00	52.40	2380.00	1.35	376.0	64.9	bmdl	bmdl	bmdl	44.70	138.0	70000	119.0
GW-AR-1A	1	381000	bmdl	bmdl	44.70	149.00	bmdl	1950.00	3.10	281.0	858.0	76.40	bmdl	bmdl	53.00	175.0	72800	119.0
GW-AR-1A	2	414000	bmdl	10.50	25.80	77.40	4.84	865.00	0.55	153.0	88.0	7.08	0.11	bmdl	62.50	223.0	92300	133.0
GW-AR-1A	3	581000	bmdl	bmdl	51.80	179.00	bmdl	1250.00	1.18	1910.0	397.0	bmdl	bmdl	bmdl	56.20	143.0	81500	130.0
GW-AR-1A	4	523000	bmdl	17.10	65.50	221.00	5.06	3080.00	2.16	73.6	88.9	10.00	0.11	bmdl	62.60	229.0	75900	126.0
GW-AR-1A	5	517000	bmdl	7.72	48.10	160.00	5.82	2710.00	1.52	121.0	42.1	5.18	0.10	bmdl	48.20	149.0	86200	134.0
GW-AR-1B	1	405000	bmdl	bmdl	43.70	149.00	bmdl	1860.00	3.10	226.0	272.0	75.50	bmdl	bmdl	52.70	184.0	76600	127.0
GW-AR-1B	2	386000	bmdl	11.60	38.60	118.00	2.64	993.00	0.96	1280.0	223.0	6.97	0.10	bmdl	67.80	221.0	111000	135.0
GW-AR-1B	3	537000	bmdl	bmdl	46.90	160.00	bmdl	1200.00	1.05	1720.0	373.0	bmdl	bmdl	bmdl	51.70	133.0	87600	126.0
GW-AR-1B	4	474000	bmdl	22.10	67.00	227.00	4.04	2770.00	2.00	64.5	81.4	9.47	bmdl	bmdl	63.00	222.0	76300	125.0
GW-AR-1B	5	516000	bmdl	8.36	53.20	182.00	4.97	2660.00	1.41	156.0	46.1	bmdl	bmdl	bmdl	47.60	170.0	87600	136.0
GW-AR-1C	1	409000	bmdl	bmdl	43.70	138.00	bmdl	1920.00	3.20	265.0	261.0	92.00	bmdl	bmdl	54.30	173.0	76900	125.0
GW-AR-1C	2	370000	bmdl	8.07	31.90	97.60	2.38	721.00	0.85	1380.0	178.0	6.60	0.10	bmdl	58.70	204.0	99500	123.0
GW-AR-1C	3	476000	bmdl	bmdl	42.30	144.00	bmdl	1180.00	1.28	1790.0	327.0	bmdl	bmdl	bmdl	53.90	139.0	78600	124.0
GW-AR-1C	4	475000	bmdl	16.60	64.90	215.00	1.73	2830.00	1.80	78.5	90.1	27.90	0.14	bmdl	62.80	221.0	74000	121.0
GW-AR-1C	5	486000	bmdl	5.96	52.40	176.00	1.71	2440.00	1.43	166.0	53.7	bmdl	bmdl	bmdl	47.10	151.0	86300	135.0
GW-PR-1A	1	418000	bmdl	bmdl	43.70	151.00	bmdl	2140.00	3.10	253.0	237.0	208.00	bmdl	bmdl	50.90	166.0	77100	128.0
GW-PR-1A	2	392000	bmdl	11.10	21.10	61.40	19.10	1460.00	0.55	651.0	92.3	6.74	0.10	bmdl	60.40	203.0	103000	129.0
GW-PR-1A	3	519000	bmdl	bmdl	43.20	156.00	26.60	1640.00	1.08	526.0	300.0	bmdl	bmdl	bmdl	52.10	138.0	74400	125.0
GW-PR-1A	4	492000	bmdl	bmdl	59.70	202.00	11.40	2740.00	1.98	74.0	86.5	8.92	0.14	bmdl	61.40	219.0	76500	122.0
GW-PR-1A	5	518000	bmdl	8.44	54.70	177.00	12.40	2790.00	1.57	149.0	51.2	9.75	bmdl	bmdl	46.10	152.0	85600	135.0
GW-PR-1B	1	391000	bmdl	bmdl	46.80	170.00	bmdl	2020.00	3.20	243.0	212.0	93.30	bmdl	bmdl	49.60	177.0	78200	137.0
GW-PR-1B	2	378000	bmdl	8.24	22.00	65.20	4.50	878.00	0.81	109.0	51.5	7.05	0.09	bmdl	64.90	207.0	106000	139.0
GW-PR-1B	3	528000	bmdl	bmdl	46.70	167.00	bmdl	1230.00	0.98	288.0	226.0	bmdl	bmdl	bmdl	54.70	152.0	81600	128.0
GW-PR-1B	4	466000	bmdl	bmdl	54.20	181.00	5.80	2690.00	1.75	65.4	82.9	11.80	0.10	bmdl	62.00	227.0	76400	123.0
GW-PR-1B	5	539000	bmdl	6.79	50.00	170.00	6.35	2720.00	1.54	152.0	47.0	6.99	bmdl	bmdl	49.20	152.0	90000	134.0

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Sr (ppb)	Y (ppb)	Zr (ppb)	Nb (ppb)	Mo (ppb)	Ru (ppb)	Pd (ppb)	Ag (ppb)	Cd (ppb)	In (ppb)	Sn (ppb)	Sb (ppb)	Te (ppb)	I (ppb)	Cs (ppb)	Ba (ppb)
GW-PP-1A	1	7890	bmdl	bmdl	bmdl	bmdl	bmdl	5.80	bmdl	bmdl	bmdl	bmdl	bmdl	1.00	bmdl	0.30	14.80
GW-PP-1A	2	11300	0.03	0.05	0.02	1.38	0.69	0.39	bmdl	bmdl	0.00	bmdl	0.07	0.47	61.60	0.30	11.40
GW-PP-1A	3	8640	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.29	12.40
GW-PP-1A	4	8610	0.07	bmdl	bmdl	1.71	1.02	1.87	bmdl	bmdl	0.11	bmdl	bmdl	0.24	97.20	0.28	12.60
GW-PP-1A	5	8010	0.06	bmdl	bmdl	bmdl	0.53	1.54	bmdl	bmdl	bmdl	bmdl	bmdl	0.28	649.00	0.29	33.30
GW-PP-1B	1	7600	bmdl	bmdl	bmdl	bmdl	bmdl	4.60	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	19.10
GW-PP-1B	2	10700	0.03	0.14	0.02	6.72	2.05	1.05	bmdl	0.03	0.01	bmdl	0.11	0.24	82.40	0.33	13.00
GW-PP-1B	3	8340	bmdl	bmdl	bmdl	bmdl	bmdl	1.31	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.25	14.20
GW-PP-1B	4	8410	0.08	bmdl	bmdl	4.76	0.77	1.88	bmdl	bmdl	0.09	bmdl	bmdl	bmdl	93.10	0.25	12.40
GW-PP-1B	5	7730	0.06	bmdl	bmdl	3.89	0.42	1.06	bmdl	bmdl	bmdl	bmdl	bmdl	0.28	584.00	0.31	14.40
GW-AR-1A	1	8920	bmdl	bmdl	bmdl	bmdl	1.10	3.40	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.30	17.60
GW-AR-1A	2	12900	0.03	0.03	0.02	1.33	0.33	0.14	bmdl	0.06	0.02	bmdl	0.08	0.72	52.90	0.35	18.30
GW-AR-1A	3	10400	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.34	16.40
GW-AR-1A	4	8860	0.08	bmdl	bmdl	bmdl	0.46	0.44	bmdl	bmdl	bmdl	bmdl	bmdl	0.28	640.00	0.31	15.60
GW-AR-1A	5	9910	0.04	bmdl	bmdl	bmdl	0.45	1.75	bmdl	bmdl	0.01	bmdl	bmdl	bmdl	586.00	0.35	18.00
GW-AR-1B	1	8540	bmdl	bmdl	bmdl	bmdl	1.80	4.50	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.30	14.50
GW-AR-1B	2	11700	0.03	0.05	0.02	11.80	2.11	0.09	bmdl	0.03	0.01	0.10	0.28	0.93	68.00	0.39	10.70
GW-AR-1B	3	9160	bmdl	bmdl	bmdl	bmdl	bmdl	1.02	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.30	10.60
GW-AR-1B	4	8120	0.05	bmdl	bmdl	1.19	0.45	0.42	bmdl	bmdl	0.02	bmdl	bmdl	0.77	554.00	0.30	11.50
GW-AR-1B	5	9020	0.04	bmdl	bmdl	3.32	0.57	1.33	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	604.00	0.32	14.50
GW-AR-1C	1	8190	bmdl	bmdl	bmdl	10.70	bmdl	4.80	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.20	10.80
GW-AR-1C	2	10600	0.03	0.01	0.01	12.00	3.71	0.72	bmdl	0.06	0.03	0.11	0.17	0.56	97.00	0.33	9.46
GW-AR-1C	3	8650	bmdl	bmdl	bmdl	bmdl	bmdl	1.30	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	150.00	0.31	bmdl
GW-AR-1C	4	7630	0.05	bmdl	bmdl	8.92	0.68	0.39	bmdl	bmdl	0.02	bmdl	0.18	0.50	723.00	0.31	8.27
GW-AR-1C	5	8140	0.05	bmdl	bmdl	10.60	0.42	1.46	bmdl	bmdl	bmdl	bmdl	0.22	0.21	560.00	0.34	8.72
GW-PR-1A	1	9710	bmdl	bmdl	bmdl	bmdl	bmdl	4.40	bmdl	bmdl	bmdl	bmdl	bmdl	1.20	bmdl	0.30	23.90
GW-PR-1A	2	13800	0.04	0.02	0.02	1.04	2.88	0.33	bmdl	0.05	0.01	bmdl	0.05	0.46	45.90	0.34	19.70
GW-PR-1A	3	10700	bmdl	bmdl	bmdl	bmdl	bmdl	1.10	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.28	18.70
GW-PR-1A	4	9570	0.05	bmdl	bmdl	bmdl	0.81	0.31	bmdl	bmdl	bmdl	bmdl	bmdl	1.04	842.00	0.31	18.50
GW-PR-1A	5	10400	0.10	bmdl	bmdl	4.07	0.43	1.61	bmdl	bmdl	0.01	bmdl	bmdl	0.28	591.00	0.34	20.20
GW-PR-1B	1	7930	bmdl	bmdl	bmdl	bmdl	1.30	3.40	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.40	16.80
GW-PR-1B	2	11600	0.02	0.04	0.01	1.78	2.68	1.10	bmdl	bmdl	0.01	bmdl	0.04	0.32	42.10	0.37	9.02
GW-PR-1B	3	8910	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.34	bmdl
GW-PR-1B	4	7670	bmdl	bmdl	bmdl	2.37	0.82	0.43	bmdl	bmdl	0.01	bmdl	bmdl	0.47	808.00	0.34	8.25
GW-PR-1B	5	8220	0.05	bmdl	bmdl	2.31	0.45	1.29	bmdl	bmdl	0.01	bmdl	bmdl	0.20	576.00	0.36	10.20

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	La (ppb)	Ce (ppb)	Pr (ppb)	Nd (ppb)	Sm (ppb)	Eu (ppb)	Gd (ppb)	Tb (ppb)	Dy (ppb)	Ho (ppb)	Er (ppb)	Tm (ppb)	Yb (ppb)	Lu (ppb)	Hf (ppb)
GW-PP-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PP-1A	2	0.020	0.004	0.006	bmdl	bmdl	bmdl	0.003	0.005	bmdl	0.004	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PP-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PP-1A	4	0.051	0.081	0.019	bmdl	bmdl	bmdl	bmdl	0.015	0.014	bmdl	0.013	bmdl	bmdl	0.067	bmdl
GW-PP-1A	5	0.023	bmdl	0.017	0.042	bmdl	bmdl	bmdl	bmdl	0.016	0.015	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PP-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PP-1B	2	0.009	bmdl	0.026	bmdl	bmdl	0.001	0.003	0.007	bmdl	0.016	0.002	bmdl	bmdl	0.001	0.006
GW-PP-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PP-1B	4	0.042	0.083	0.017	0.054	bmdl	bmdl	0.024	0.010	bmdl	bmdl	0.011	bmdl	bmdl	0.055	bmdl
GW-PP-1B	5	0.016	0.025	0.013	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.017	bmdl	bmdl	0.014	bmdl	bmdl
GW-AR-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1A	2	0.018	0.007	0.008	0.006	0.004	0.004	bmdl	0.007	bmdl	0.007	0.004	bmdl	bmdl	0.002	bmdl
GW-AR-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1A	4	0.013	0.024	bmdl	0.412	bmdl	bmdl	bmdl	0.014	0.466	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1A	5	0.019	0.029	bmdl	0.054	bmdl	bmdl	bmdl	bmdl	bmdl	0.025	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1B	2	0.021	0.003	0.020	bmdl	bmdl	bmdl	0.005	0.005	0.002	0.017	bmdl	bmdl	bmdl	0.001	bmdl
GW-AR-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1B	4	0.012	bmdl	bmdl	0.336	0.025	bmdl	0.055	bmdl	0.465	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1B	5	0.023	bmdl	bmdl	0.043	bmdl	bmdl	bmdl	bmdl	bmdl	0.014	0.012	bmdl	bmdl	bmdl	bmdl
GW-AR-1C	1	bmdl	0.300	bmdl	0.500	bmdl	bmdl	bmdl	0.100	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1C	2	0.060	0.007	0.039	0.022	0.011	bmdl	0.006	0.007	0.006	0.034	bmdl	0.002	0.004	0.002	0.004
GW-AR-1C	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1C	4	0.023	0.026	0.010	0.417	0.031	bmdl	0.043	0.013	0.550	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-AR-1C	5	0.016	bmdl	bmdl	bmdl	0.021	bmdl	bmdl	bmdl	0.011	0.015	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.100	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1A	2	0.011	0.018	0.014	0.014	0.012	0.005	0.006	0.007	0.001	0.021	bmdl	bmdl	0.007	bmdl	bmdl
GW-PR-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1A	4	0.011	0.032	0.012	0.477	bmdl	bmdl	bmdl	bmdl	0.183	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1A	5	bmdl	bmdl	0.015	bmdl	0.034	bmdl	bmdl	bmdl	bmdl	0.014	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1B	2	0.020	bmdl	0.008	0.009	0.005	0.001	bmdl	0.003	bmdl	0.035	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
GW-PR-1B	4	0.027	bmdl	0.010	0.493	bmdl	bmdl	0.026	bmdl	0.499	bmdl	bmdl	bmdl	bmdl	bmdl	0.024
GW-PR-1B	5	0.020	0.027	0.014	0.103	0.021	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	Ta (ppb)	W (ppb)	Re (ppb)	Os (ppb)	Pt (ppb)	Au (ppb)	Hg (ppb)	Tl (ppb)	Pb (ppb)	Bi (ppb)	Th (ppb)	U (ppb)	DOC (mg/L)	TOC (mg/L)	NO2- (mg/L)
GW-PP-1A	1	bmdl	6.600	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	19.200	1.500	bmdl	0.600	3.00	2.80	0.002
GW-PP-1A	2	0.001	1.020	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.002	0.337	3.00	3.00	0.004
GW-PP-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.428	3.70	nd	0.001
GW-PP-1A	4	bmdl	0.338	0.011	bmdl	bmdl	bmdl	bmdl	bmdl	1.520	0.120	0.083	0.688	3.70	nd	0.003
GW-PP-1A	5	bmdl	0.997	bmdl	bmdl	bmdl	0.055	bmdl	bmdl	bmdl	bmdl	bmdl	0.241	4.83	nd	0.004
GW-PP-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.700	bmdl	bmdl	3.80	3.80	0.002
GW-PP-1B	2	0.002	0.124	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.001	0.953	3.60	3.60	0.003
GW-PP-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.457	4.20	nd	0.001
GW-PP-1B	4	bmdl	bmdl	bmdl	bmdl	bmdl	0.046	bmdl	bmdl	3.110	0.267	0.102	0.917	3.90	nd	0.002
GW-PP-1B	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.264	4.19	nd	0.003
GW-AR-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	17.000	1.700	bmdl	4.900	1.30	1.30	0.002
GW-AR-1A	2	bmdl	0.049	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.860	1.60	1.40	0.003
GW-AR-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.760	1.40	nd	0.002
GW-AR-1A	4	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.388	bmdl	9.000	1.50	nd	0.002
GW-AR-1A	5	bmdl	bmdl	bmdl	bmdl	bmdl	0.043	bmdl	bmdl	1.150	bmdl	0.011	1.580	1.03	nd	0.003
GW-AR-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.300	bmdl	2.200	1.10	0.80	0.002
GW-AR-1B	2	bmdl	0.060	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.002	3.160	0.70	0.80	0.003
GW-AR-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.320	0.90	nd	0.002
GW-AR-1B	4	0.014	bmdl	bmdl	bmdl	0.112	bmdl	bmdl	bmdl	bmdl	0.391	bmdl	1.680	1.00	nd	0.002
GW-AR-1B	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	4.970	bmdl	bmdl	1.810	1.00	nd	0.004
GW-AR-1C	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.200	1.10	0.80	0.003
GW-AR-1C	2	0.002	0.038	bmdl	bmdl	bmdl	0.004	0.276	bmdl	bmdl	bmdl	0.004	2.670	0.80	0.80	0.003
GW-AR-1C	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.460	0.90	nd	0.002
GW-AR-1C	4	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.296	bmdl	2.650	1.00	nd	0.004
GW-AR-1C	5	bmdl	bmdl	bmdl	bmdl	bmdl	0.032	bmdl	bmdl	bmdl	bmdl	bmdl	2.840	0.88	nd	0.005
GW-PR-1A	1	bmdl	bmdl	bmdl	bmdl	bmdl	0.200	bmdl	bmdl	bmdl	1.200	bmdl	7.100	1.10	1.00	0.002
GW-PR-1A	2	0.002	0.704	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.006	1.910	1.00	1.00	0.004
GW-PR-1A	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	2.200	1.10	nd	0.001
GW-PR-1A	4	0.018	0.509	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	10.500	0.484	bmdl	2.780	1.11	nd	0.002
GW-PR-1A	5	bmdl	0.615	bmdl	bmdl	bmdl	0.020	bmdl	bmdl	bmdl	bmdl	bmdl	3.980	0.74	nd	0.003
GW-PR-1B	1	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	17.100	bmdl	bmdl	4.700	0.80	0.80	0.002
GW-PR-1B	2	0.002	0.462	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.003	4.180	0.70	0.70	0.004
GW-PR-1B	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	4.240	0.70	nd	0.001
GW-PR-1B	4	0.013	0.852	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.050	0.417	bmdl	3.350	0.98	nd	0.002
GW-PR-1B	5	bmdl	1.110	bmdl	bmdl	bmdl	0.030	bmdl	bmdl	bmdl	bmdl	0.018	3.060	0.74	nd	0.003

[bmdl, below method detection limit; nd, no data]

Appendix A-1. Hydrochemistry results for groundwater samples, cont.

Location ID	Sampling Round	NO3- (mg/L)	NH4+ (mg/L)	DIN (mg/L)	TSN (mg/L)	TN (mg/L)	SRP (mg/L)	TSP (mg/L)	TP (mg/L)	Sol. SiO2 (mg/L)	SO4 (mM)
GW-PP-1A	1	0.000	0.132	0.134	0.236	0.236	0.068	0.064	0.067	2.430	27.8
GW-PP-1A	2	0.000	0.164	0.168	0.148	nd	0.055	0.061	nd	2.325	nd
GW-PP-1A	3	0.002	0.139	0.142	0.142	nd	0.051	0.069	nd	1.463	nd
GW-PP-1A	4	0.002	0.240	0.245	0.359	nd	0.079	0.086	nd	2.323	nd
GW-PP-1A	5	0.000	0.993	0.997	1.477	nd	0.282	0.363	nd	6.192	nd
GW-PP-1B	1	0.000	0.089	0.091	0.210	0.204	0.068	0.063	0.063	1.900	26.5
GW-PP-1B	2	0.008	0.079	0.090	0.192	nd	0.058	0.062	nd	1.391	nd
GW-PP-1B	3	0.001	0.331	0.333	0.415	nd	0.118	0.122	nd	1.752	nd
GW-PP-1B	4	0.004	0.232	0.237	0.380	nd	0.077	0.077	nd	1.777	nd
GW-PP-1B	5	0.001	0.342	0.346	0.638	nd	0.116	0.116	nd	2.369	nd
GW-AR-1A	1	0.000	0.128	0.130	0.146	0.146	0.039	0.037	0.038	3.460	30.1
GW-AR-1A	2	0.000	0.179	0.182	0.257	nd	0.043	0.047	nd	3.693	nd
GW-AR-1A	3	0.000	0.197	0.199	0.199	nd	0.046	0.062	nd	3.298	nd
GW-AR-1A	4	0.004	0.165	0.171	0.171	nd	0.049	0.049	nd	3.338	nd
GW-AR-1A	5	0.001	0.170	0.174	0.174	nd	0.066	0.066	nd	4.323	nd
GW-AR-1B	1	0.000	0.246	0.248	0.279	0.285	0.034	0.033	0.034	2.020	30.1
GW-AR-1B	2	0.000	0.254	0.257	0.130	nd	0.027	0.036	nd	1.495	nd
GW-AR-1B	3	0.001	0.265	0.267	0.267	nd	0.033	0.054	nd	1.290	nd
GW-AR-1B	4	0.000	0.298	0.300	0.300	nd	0.040	0.040	nd	2.546	nd
GW-AR-1B	5	0.000	0.267	0.271	0.271	nd	0.046	0.046	nd	3.068	nd
GW-AR-1C	1	0.018	0.083	0.104	0.235	0.237	0.021	0.022	0.022	0.780	29.4
GW-AR-1C	2	0.005	0.122	0.130	0.355	nd	0.017	0.023	nd	0.614	nd
GW-AR-1C	3	0.006	0.145	0.153	0.153	nd	0.020	0.024	nd	0.119	nd
GW-AR-1C	4	0.026	0.077	0.107	0.107	nd	0.025	0.025	nd	0.655	nd
GW-AR-1C	5	0.025	0.053	0.083	0.100	nd	0.029	0.029	nd	0.620	nd
GW-PR-1A	1	0.000	0.246	0.248	0.314	0.321	0.017	0.018	0.017	3.550	29.1
GW-PR-1A	2	0.000	0.351	0.355	0.200	nd	0.023	0.029	nd	3.516	nd
GW-PR-1A	3	0.002	0.385	0.388	0.388	nd	0.031	0.031	nd	2.725	nd
GW-PR-1A	4	0.000	0.355	0.357	0.357	nd	0.029	0.029	nd	3.525	nd
GW-PR-1A	5	0.001	0.340	0.344	0.395	nd	0.032	0.032	nd	3.262	nd
GW-PR-1B	1	0.000	0.317	0.319	0.360	0.365	0.045	0.044	0.044	1.480	30.0
GW-PR-1B	2	0.000	0.196	0.200	0.926	nd	0.030	0.035	nd	0.662	nd
GW-PR-1B	3	0.002	0.261	0.264	0.264	nd	0.031	0.049	nd	0.000	nd
GW-PR-1B	4	0.000	0.304	0.306	0.411	nd	0.037	0.038	nd	1.065	nd
GW-PR-1B	5	0.001	0.328	0.332	0.406	nd	0.034	0.036	nd	1.032	nd

[bmdl, below method detection limit; nd, no data]

Appendix A-2. Surface water hydrochemistry results

Location ID	Location Name	Water Type	Well Depth (ft)	Latitude (N)	Longitude (W)	Sampling Round	Date of Collection	Time of Collection
SW-BPI	Black Point Inshore	SW	0	25.526	-80.330	1	8/22/02	8:20
SW-BPI	Black Point Inshore	SW	0	25.526	-80.330	2	6/24/03	17:00
SW-BPI	Black Point Inshore	SW	0	25.526	-80.330	3	9/24/03	16:24
SW-BPI	Black Point Inshore	SW	0	25.526	-80.330	4	12/17/03	14:00
SW-BPI	Black Point Inshore	SW	0	25.526	-80.330	5	3/31/04	8:25
SW-BKP	Black Point	SW	0	25.526	-80.324	1	nd	nd
SW-BKP	Black Point	SW	0	25.526	-80.324	2	6/25/03	15:15
SW-BKP	Black Point	SW	0	25.526	-80.324	3	9/24/03	15:05
SW-BKP	Black Point	SW	0	25.526	-80.324	4	12/17/03	12:50
SW-BKP	Black Point	SW	0	25.526	-80.324	5	3/29/04	11:40
SW-MB	Mid Bay	SW	0	25.484	-80.267	1	8/22/02	15:15
SW-MB	Mid Bay	SW	0	25.484	-80.267	2	6/24/03	12:10
SW-MB	Mid Bay	SW	0	25.484	-80.267	3	9/24/03	12:30
SW-MB	Mid Bay	SW	0	25.484	-80.267	4	12/15/03	15:00
SW-MB	Mid Bay	SW	0	25.484	-80.267	5	3/29/04	13:30
SW-BYP	Billy's Point	SW	0	25.428	-80.212	1	8/21/02	12:20
SW-BYP	Billy's Point	SW	0	25.428	-80.212	2	6/24/03	9:30
SW-BYP	Billy's Point	SW	0	25.428	-80.212	3	9/24/03	9:10
SW-BYP	Billy's Point	SW	0	25.428	-80.212	4	12/16/03	12:30
SW-BYP	Billy's Point	SW	0	25.428	-80.212	5	3/29/04	10:55
SW-PP	Petrel Point	SW	0	25.415	-80.204	1	8/21/02	9:30
SW-PP	Petrel Point	SW	0	25.415	-80.204	2	6/25/03	9:00
SW-PP	Petrel Point	SW	0	25.415	-80.204	3	9/23/03	14:55
SW-PP	Petrel Point	SW	0	25.415	-80.204	4	12/16/03	10:00
SW-PP	Petrel Point	SW	0	25.415	-80.204	5	3/29/04	8:50
SW-AR	Alina's Reef	SW	0	25.386	-80.163	1	8/20/02	13:25
SW-AR	Alina's Reef	SW	0	25.386	-80.163	2	6/26/03	9:10
SW-AR	Alina's Reef	SW	0	25.386	-80.163	3	9/23/03	12:10
SW-AR	Alina's Reef	SW	0	25.386	-80.163	4	1/14/04	13:15
SW-AR	Alina's Reef	SW	0	25.386	-80.163	5	3/30/04	8:20
SW-PR	Pacific Reef	SW	0	25.371	-80.142	1	8/20/02	10:45
SW-PR	Pacific Reef	SW	0	25.371	-80.142	2	6/25/03	11:45
SW-PR	Pacific Reef	SW	0	25.371	-80.142	3	9/23/03	10:10
SW-PR	Pacific Reef	SW	0	25.371	-80.142	4	1/14/04	10:15
SW-PR	Pacific Reef	SW	0	25.371	-80.142	5	3/30/04	11:45
SW-Gulf Stream	Gulf Stream	SW	0	nd	nd	1	nd	nd
SW-Gulf Stream	Gulf Stream	SW	0	25.377	-80.132	2	6/25/03	13:45
SW-Gulf Stream	Gulf Stream	SW	0	25.372	-80.128	3	9/23/03	9:10
SW-Gulf Stream	Gulf Stream	SW	0	25.349	-80.122	4	1/14/04	9:20
SW-Gulf Stream	Gulf Stream	SW	0	25.349	-80.122	5	3/30/04	11:10

[nd, no data]

Appendix A-2. Surface water hydrochemistry results, Cont.

Location ID	Sampling Round	Sp. Conductance (µS/CM)	Salinity (ppt)	Diss. Oxygen (mg/L)	Diss Oxy (%)	pH	Temp (ûC)	Redox (mV)	Li (ppb)	Be (ppb)	B (ppb)	Na (ppb)	Mg (ppb)
SW-BPI	1	5210	2.8	5.22	nd	7.91	28.2	nd	nd	nd	nd	nd	nd
SW-BPI	2	9330	5.3	5.75	74.0	8.13	28.3	-52.0	31.1	bmdl	853	1650000	180000
SW-BPI	3	11000	6.3	nd	nd	8.25	nd	nd	bmdl	bmdl	1030	1940000	236000
SW-BPI	4	28900	17.8	6.88	89.3	8.11	23.1	-9.5	115	bmdl	2500	5750000	687000
SW-BPI	5	47735	31.1	3.85	55.0	8.10	23.3	137.6	170	bmdl	3900	9740000	1170000
SW-BKP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BKP	2	9500	5.4	7.07	91.5	7.86	34.4	4.0	56.9	bmdl	1110	2750000	320000
SW-BKP	3	19260	11.5	nd	nd	8.16	nd	nd	bmdl	bmdl	1760	4060000	455000
SW-BKP	4	28910	17.9	9.05	115.8	8.22	22.5	156.0	123	bmdl	2780	5790000	721000
SW-BKP	5	49019	32.1	8.73	123.5	8.27	23.4	94.9	179	bmdl	4160	10200000	1250000
SW-MB	1	54400	36.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-MB	2	48300	31.7	4.55	57.9	8.16	28.0	-51.0	181	bmdl	2390	10100000	1150000
SW-MB	3	49900	32.5	nd	nd	7.70	nd	nd	172	bmdl	4430	11700000	1420000
SW-MB	4	47940	31.3	6.77	90.2	8.14	20.4	202.0	174	bmdl	4110	10200000	1200000
SW-MB	5	54718	36.3	6.57	94.0	8.13	22.7	49.0	205	bmdl	4560	11200000	1390000
SW-BYP	1	53200	35.1	7.73	nd	8.06	30.3	nd	nd	nd	nd	nd	nd
SW-BYP	2	50600	33.3	4.58	57.9	8.14	31.6	24.0	187	bmdl	2480	10700000	1240000
SW-BYP	3	54200	35.7	nd	nd	7.78	nd	nd	182	bmdl	4870	12700000	1510000
SW-BYP	4	51720	34.1	6.86	93.4	8.08	20.6	117.5	193	bmdl	4450	10500000	1380000
SW-BYP	5	55858	37.1	5.62	82.0	8.18	23.4	22.3	213	bmdl	4940	12400000	1450000
SW-PP	1	54600	36.2	7.23	nd	7.79	29.0	nd	nd	nd	nd	nd	nd
SW-PP	2	53500	35.5	5.26	66.5	7.98	27.1	39.0	209	bmdl	3390	11500000	1330000
SW-PP	3	51800	34.4	19.90	193.8	8.69	32.9	nd	185	bmdl	4500	13000000	1320000
SW-PP	4	51410	33.8	6.45	88.1	8.01	20.9	165.0	187	bmdl	4480	10500000	1310000
SW-PP	5	54476	36.1	5.33	75.2	8.19	22.0	121.8	204	bmdl	4760	11800000	1440000
SW-AR	1	54304	36.0	4.43	nd	nd	30.3	nd	nd	nd	nd	nd	nd
SW-AR	2	53800	35.8	7.73	99.5	8.20	30.6	43.0	202	0.185	2780	11800000	1360000
SW-AR	3	52900	35.1	7.12	94.5	8.33	29.1	nd	190	bmdl	4740	13800000	1370000
SW-AR	4	53120	35.1	6.44	90.0	8.12	21.8	24.7	188	bmdl	4440	11100000	1380000
SW-AR	5	54020	35.7	6.35	91.3	8.13	23.3	128.4	198	bmdl	4550	11400000	1400000
SW-PR	1	53763	35.6	4.22	nd	nd	29.8	nd	nd	nd	nd	nd	nd
SW-PR	2	53700	35.7	7.40	95.2	8.22	28.4	47.0	212	bmdl	3020	11700000	1340000
SW-PR	3	52900	35.1	6.35	84.4	8.36	29.2	nd	192	bmdl	4930	12700000	1450000
SW-PR	4	53702	35.5	6.00	86.4	8.13	23.3	122.2	180	bmdl	4050	11200000	1390000
SW-PR	5	53892	35.6	6.69	99.1	8.19	25.1	66.7	205	bmdl	4700	11200000	1350000
SW-Gulf Stream	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-Gulf Stream	2	53600	35.6	7.28	94.0	8.20	28.6	-62.0	200	bmdl	2610	11900000	1370000
SW-Gulf Stream	3	52900	35.1	5.56	72.8	8.33	29.3	nd	189	bmdl	4810	13200000	1420000
SW-Gulf Stream	4	53829	35.6	5.90	86.7	8.11	24.6	180.8	178	bmdl	4350	11200000	1390000
SW-Gulf Stream	5	53868	35.6	6.36	94.4	8.16	25.1	34.5	201	bmdl	4810	11400000	1350000

[bmdl, below method detection limit; nd, no data]

Appendix A-2. Surface water hydrochemistry results, Cont.

Location ID	Sampling Round	Al (ppb)	Si (ppb)	K (ppb)	Ca (ppb)	Sc (ppb)	Ti (ppb)	V (ppb)	Cr (ppb)	Mn (ppb)	Fe (ppb)	Co (ppb)	Ni (ppb)	Cu (ppb)	Zn (ppb)	Ga (ppb)	Ge (ppb)	As (ppb)
SW-BPI	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BPI	2	bmdl	2080	55000	110000	bmdl	1.45	bmdl	bmdl	12.20	301.00	0.39	331.00	27.50	1.93	0.02	bmdl	8.17
SW-BPI	3	bmdl	bmdl	78900	138000	bmdl	bmdl	7.81	bmdl	bmdl	bmdl	bmdl	157.00	30.60	bmdl	bmdl	bmdl	7.12
SW-BPI	4	30.3	1100	207000	265000	bmdl	6.04	28.50	92.10	4.41	1620.00	0.97	32.10	17.50	bmdl	bmdl	bmdl	25.50
SW-BPI	5	bmdl	bmdl	385000	463000	bmdl	3.56	40.60	141.00	7.72	2410.00	1.36	116.00	34.70	bmdl	bmdl	bmdl	39.30
SW-BKP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BKP	2	bmdl	bmdl	92000	146000	bmdl	2.30	bmdl	bmdl	8.61	373.00	0.31	406.00	41.30	2.07	0.03	bmdl	13.90
SW-BKP	3	bmdl	bmdl	149000	212000	bmdl	bmdl	13.80	bmdl	bmdl	516.00	bmdl	836.00	116.00	bmdl	bmdl	bmdl	14.00
SW-BKP	4	29.9	764	219000	272000	bmdl	3.82	29.80	94.10	5.57	1730.00	0.94	47.90	22.30	11.30	bmdl	bmdl	27.10
SW-BKP	5	bmdl	bmdl	420000	477000	bmdl	6.39	47.80	161.00	3.45	2480.00	1.33	306.00	62.60	bmdl	bmdl	bmdl	42.70
SW-MB	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-MB	2	bmdl	bmdl	345000	332000	bmdl	10.00	21.80	58.10	1.98	788.00	1.11	1180.00	177.00	6.46	0.09	bmdl	54.20
SW-MB	3	bmdl	bmdl	453000	489000	bmdl	bmdl	43.20	150.00	bmdl	1060.00	1.11	549.00	180.00	bmdl	bmdl	bmdl	50.30
SW-MB	4	27.0	bmdl	369000	375000	bmdl	7.73	54.90	193.00	1.39	2660.00	1.46	66.70	39.60	7.81	0.12	bmdl	50.50
SW-MB	5	bmdl	bmdl	453000	493000	bmdl	7.09	57.90	182.00	1.80	2730.00	1.58	257.00	68.50	7.12	bmdl	bmdl	52.10
SW-BYP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BYP	2	2.1	bmdl	362000	350000	bmdl	10.50	29.90	89.30	1.96	853.00	0.82	1070.00	180.00	6.46	0.10	bmdl	58.10
SW-BYP	3	bmdl	bmdl	490000	514000	bmdl	bmdl	45.80	149.00	bmdl	1130.00	1.10	1550.00	317.00	bmdl	bmdl	bmdl	53.90
SW-BYP	4	26.4	bmdl	408000	438000	bmdl	10.20	59.50	197.00	1.60	3140.00	1.84	98.30	44.60	10.60	bmdl	bmdl	56.80
SW-BYP	5	bmdl	bmdl	469000	516000	bmdl	6.93	56.50	186.00	1.42	2700.00	1.47	221.00	55.60	6.14	bmdl	bmdl	51.00
SW-PP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PP	2	3.3	bmdl	356000	368000	bmdl	9.81	31.30	88.50	1.61	803.00	0.95	771.00	155.00	7.77	0.08	bmdl	67.00
SW-PP	3	bmdl	bmdl	450000	472000	bmdl	bmdl	42.30	146.00	bmdl	957.00	1.16	bmdl	93.10	bmdl	bmdl	bmdl	52.70
SW-PP	4	26.8	bmdl	409000	419000	bmdl	10.60	55.90	183.00	1.61	2780.00	1.42	106.00	42.30	10.60	bmdl	bmdl	54.90
SW-PP	5	bmdl	bmdl	465000	503000	bmdl	6.42	51.90	171.00	1.34	2570.00	1.76	216.00	53.60	6.84	bmdl	bmdl	49.40
SW-AR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-AR	2	bmdl	bmdl	355000	385000	bmdl	8.49	39.30	115.00	0.75	764.00	0.84	1280.00	192.00	7.39	0.07	bmdl	63.70
SW-AR	3	bmdl	bmdl	456000	486000	bmdl	bmdl	43.80	140.00	bmdl	1100.00	0.95	44.20	118.00	bmdl	bmdl	bmdl	52.00
SW-AR	4	bmdl	bmdl	466000	475000	bmdl	11.70	70.10	225.00	1.04	2760.00	1.88	70.90	82.90	13.10	0.11	bmdl	63.20
SW-AR	5	33.4	bmdl	463000	501000	bmdl	7.55	57.90	182.00	1.28	2730.00	1.46	248.00	64.00	bmdl	bmdl	bmdl	49.30
SW-PR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PR	2	bmdl	bmdl	342000	370000	bmdl	10.10	19.80	124.00	0.86	857.00	0.95	1240.00	207.00	8.62	0.13	bmdl	71.10
SW-PR	3	bmdl	bmdl	472000	500000	bmdl	bmdl	46.30	152.00	bmdl	1120.00	1.45	122.00	169.00	bmdl	bmdl	bmdl	55.30
SW-PR	4	bmdl	bmdl	448000	462000	bmdl	bmdl	51.80	166.00	1.72	2690.00	1.95	80.40	84.50	8.52	bmdl	bmdl	64.90
SW-PR	5	bmdl	bmdl	456000	503000	bmdl	5.82	58.60	195.00	1.17	2490.00	1.60	330.00	70.10	bmdl	bmdl	bmdl	50.20
SW-Gulf Stream	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-Gulf Stream	2	bmdl	bmdl	420000	384000	bmdl	9.98	30.00	84.20	0.75	806.00	0.84	1250.00	200.00	7.09	0.08	bmdl	62.90
SW-Gulf Stream	3	bmdl	bmdl	465000	493000	bmdl	bmdl	44.60	152.00	bmdl	1200.00	1.25	1540.00	310.00	bmdl	bmdl	bmdl	53.60
SW-Gulf Stream	4	bmdl	bmdl	461000	464000	bmdl	6.94	61.00	205.00	1.42	2750.00	1.87	79.20	91.40	17.50	0.10	bmdl	65.20
SW-Gulf Stream	5	bmdl	bmdl	449000	490000	bmdl	8.34	58.80	192.00	1.01	2530.00	1.77	164.00	60.90	6.81	bmdl	bmdl	49.50

[bmdl, below method detection limit; nd, no data]

Appendix A-2. Surface water hydrochemistry results, Cont.

Location ID	Sampling Round	Br (ppb)	Se (ppb)	Rb (ppb)	Sr (ppb)	Y (ppb)	Zr (ppb)	Nb (ppb)	Mo (ppb)	Ru (ppb)	Pd (ppb)	Ag (ppb)	Cd (ppb)	In (ppb)	Sn (ppb)	Sb (ppb)
SW-BPI	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BPI	2	11300	25.1	19.9	2220	0.019	0.032	bmdl	1.660	0.036	0.522	bmdl	bmdl	0.002	bmdl	0.130
SW-BPI	3	12500	bmdl	22.1	1970	bmdl	bmdl	bmdl	bmdl	bmdl	1.030	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BPI	4	37000	85.7	59.6	4450	0.046	bmdl	bmdl	2.280	0.134	0.907	bmdl	bmdl	0.067	bmdl	0.103
SW-BPI	5	66600	117.0	116.0	6840	0.049	bmdl	bmdl	8.120	0.251	1.100	bmdl	bmdl	bmdl	bmdl	0.135
SW-BKP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BKP	2	26000	46.0	32.3	3380	0.016	0.023	bmdl	2.470	0.192	0.101	bmdl	bmdl	bmdl	bmdl	0.134
SW-BKP	3	24200	34.2	39.8	3230	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BKP	4	38600	84.3	62.2	4590	0.087	bmdl	bmdl	1.920	0.323	0.869	bmdl	bmdl	0.089	bmdl	0.138
SW-BKP	5	73500	137.0	118.0	7370	0.051	bmdl	bmdl	8.570	0.490	0.904	bmdl	bmdl	bmdl	bmdl	0.153
SW-MB	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-MB	2	90900	182.0	112.0	9900	0.025	0.013	0.014	9.700	0.958	1.830	bmdl	0.044	0.006	bmdl	0.218
SW-MB	3	73400	125.0	121.0	8630	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-MB	4	65400	180.0	106.0	7660	0.075	bmdl	bmdl	5.450	0.560	1.870	bmdl	bmdl	0.148	bmdl	0.185
SW-MB	5	88900	156.0	137.0	7970	0.081	bmdl	bmdl	11.700	0.916	1.260	bmdl	bmdl	0.011	bmdl	0.214
SW-BYP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BYP	2	102000	195.0	128.0	10600	0.021	0.013	0.011	10.900	3.160	1.020	bmdl	0.047	0.004	0.104	0.229
SW-BYP	3	77500	133.0	123.0	8820	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BYP	4	72900	192.0	116.0	8070	0.065	bmdl	bmdl	5.810	0.683	1.650	bmdl	bmdl	0.141	bmdl	0.153
SW-BYP	5	91600	162.0	141.0	8450	0.061	bmdl	bmdl	11.800	0.608	1.300	bmdl	bmdl	0.012	bmdl	0.154
SW-PP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PP	2	95400	225.0	134.0	11000	0.022	bmdl	0.025	12.400	0.232	0.491	bmdl	0.057	0.031	bmdl	0.251
SW-PP	3	76700	147.0	124.0	8390	bmdl	bmdl	bmdl	bmdl	bmdl	1.970	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PP	4	71000	203.0	116.0	8160	0.093	bmdl	bmdl	5.640	1.110	1.980	bmdl	bmdl	0.158	bmdl	0.155
SW-PP	5	89600	162.0	136.0	8640	0.060	bmdl	bmdl	12.000	0.673	0.842	bmdl	0.115	bmdl	bmdl	0.184
SW-AR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-AR	2	102000	220.0	126.0	10600	0.044	0.020	0.019	12.800	2.500	0.402	bmdl	0.043	0.009	bmdl	0.251
SW-AR	3	76400	136.0	124.0	8350	bmdl	bmdl	bmdl	bmdl	bmdl	2.070	bmdl	bmdl	bmdl	bmdl	bmdl
SW-AR	4	73800	215.0	122.0	7560	0.042	bmdl	bmdl	9.440	0.693	0.382	bmdl	bmdl	bmdl	bmdl	0.132
SW-AR	5	87900	153.0	136.0	8070	0.065	bmdl	bmdl	11.100	0.603	1.070	bmdl	bmdl	bmdl	bmdl	0.165
SW-PR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PR	2	107000	253.0	138.0	11500	0.048	0.027	0.028	13.200	0.902	1.620	bmdl	0.069	0.019	0.136	0.226
SW-PR	3	78700	140.0	128.0	8490	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PR	4	79700	234.0	132.0	7680	0.036	bmdl	bmdl	9.210	1.030	0.340	bmdl	bmdl	bmdl	bmdl	0.204
SW-PR	5	89700	150.0	140.0	7820	0.068	bmdl	bmdl	11.100	0.610	1.150	bmdl	bmdl	0.018	bmdl	0.141
SW-Gulf Stream	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-Gulf Stream	2	104000	219.0	134.0	11500	0.038	0.020	0.020	13.000	0.965	0.022	bmdl	0.014	0.006	bmdl	0.222
SW-Gulf Stream	3	76700	133.0	123.0	8510	bmdl	bmdl	bmdl	bmdl	bmdl	2.190	bmdl	bmdl	bmdl	bmdl	bmdl
SW-Gulf Stream	4	76500	241.0	126.0	7650	0.072	bmdl	bmdl	9.330	0.645	0.308	bmdl	bmdl	bmdl	bmdl	0.155
SW-Gulf Stream	5	89600	160.0	141.0	8220	0.062	bmdl	bmdl	10.900	0.922	0.474	bmdl	bmdl	0.015	bmdl	0.304

[bmdl, below method detection limit; nd, no data]

Appendix A-2. Surface water hydrochemistry results, Cont.

Location ID	Sampling Round	Te (ppb)	I (ppb)	Cs (ppb)	Ba (ppb)	La (ppb)	Ce (ppb)	Pr (ppb)	Nd (ppb)	Sm (ppb)	Eu (ppb)	Gd (ppb)	Tb (ppb)	Dy (ppb)	Ho (ppb)	Er (ppb)
SW-BPI	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BPI	2	bmdl	17.700	0.061	16.000	0.003	0.006	0.001	bmdl	bmdl	0.001	bmdl	0.003	bmdl	bmdl	bmdl
SW-BPI	3	bmdl	bmdl	bmdl	16.100	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BPI	4	0.657	19.600	0.160	13.200	0.047	0.085	0.016	0.107	bmdl	bmdl	bmdl	0.020	bmdl	bmdl	bmdl
SW-BPI	5	bmdl	521.000	0.295	14.500	bmdl	bmdl	0.014	bmdl	0.021	0.012	bmdl	bmdl	0.014	0.016	bmdl
SW-BKP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BKP	2	0.072	20.500	0.095	16.900	0.001	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.001	bmdl	0.002	bmdl
SW-BKP	3	bmdl	bmdl	bmdl	14.600	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BKP	4	0.425	20.800	0.147	12.200	0.049	0.101	0.016	0.081	bmdl	0.017	bmdl	0.017	0.017	bmdl	0.013
SW-BKP	5	0.113	540.000	0.274	11.600	0.031	0.020	0.015	0.058	bmdl	bmdl	bmdl	0.015	bmdl	bmdl	bmdl
SW-MB	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-MB	2	0.255	39.400	0.300	10.700	0.038	bmdl	0.012	0.007	0.009	bmdl	0.002	0.004	0.006	0.017	0.002
SW-MB	3	bmdl	bmdl	0.298	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-MB	4	bmdl	31.300	0.246	7.670	0.056	0.084	0.015	bmdl	0.033	bmdl	bmdl	0.017	0.013	bmdl	bmdl
SW-MB	5	0.442	571.000	0.313	10.400	0.011	bmdl	0.017	bmdl	bmdl	0.016	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BYP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BYP	2	0.357	35.800	0.348	8.050	0.025	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.004	bmdl	0.036	bmdl
SW-BYP	3	bmdl	bmdl	0.254	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BYP	4	bmdl	40.500	0.271	6.770	0.056	0.091	bmdl	bmdl	bmdl	bmdl	bmdl	0.014	bmdl	0.011	bmdl
SW-BYP	5	0.193	557.000	0.341	8.470	0.012	bmdl	0.022	0.099	bmdl	bmdl	bmdl	bmdl	0.029	0.020	bmdl
SW-PP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PP	2	0.369	35.700	0.354	8.600	0.017	0.005	0.014	0.027	bmdl	0.004	0.014	0.013	0.008	0.014	0.003
SW-PP	3	bmdl	bmdl	0.326	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PP	4	1.120	43.600	0.269	6.970	0.055	0.091	0.013	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.014	bmdl
SW-PP	5	0.359	558.000	0.345	11.500	0.020	0.022	0.027	bmdl	bmdl	bmdl	0.024	0.010	0.017	0.019	bmdl
SW-AR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-AR	2	0.357	73.900	0.315	7.850	0.003	0.006	0.018	0.029	bmdl	0.003	bmdl	0.009	0.006	0.047	0.003
SW-AR	3	bmdl	113.000	0.309	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-AR	4	bmdl	732.000	0.309	7.350	0.028	bmdl	bmdl	0.436	bmdl	bmdl	bmdl	bmdl	0.426	bmdl	bmdl
SW-AR	5	0.122	548.000	0.358	7.640	0.022	0.030	0.013	0.055	bmdl	bmdl	bmdl	bmdl	0.012	0.020	bmdl
SW-PR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PR	2	0.695	61.800	0.406	9.010	0.073	0.011	0.011	0.011	bmdl	0.002	0.006	0.009	0.018	0.056	0.010
SW-PR	3	bmdl	bmdl	0.282	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PR	4	0.503	760.000	0.331	7.100	0.016	bmdl	bmdl	0.217	0.021	0.011	0.036	bmdl	0.290	bmdl	bmdl
SW-PR	5	0.226	532.000	0.382	7.740	0.028	bmdl	0.016	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.013	bmdl
SW-Gulf Stream	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-Gulf Stream	2	0.653	61.600	0.327	8.200	0.015	0.004	0.012	bmdl	bmdl	0.002	bmdl	0.005	0.004	0.010	0.003
SW-Gulf Stream	3	bmdl	bmdl	0.312	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-Gulf Stream	4	0.640	801.000	0.314	7.240	0.022	0.029	bmdl	0.300	bmdl	0.014	bmdl	0.011	0.328	bmdl	bmdl
SW-Gulf Stream	5	0.221	540.000	0.334	8.760	0.024	bmdl	bmdl	0.097	0.027	bmdl	bmdl	0.015	bmdl	0.012	bmdl

[bmdl, below method detection limit; nd, no data]

Appendix A-2. Surface water hydrochemistry results, Cont.

Location ID	Sampling Round	Tm (ppb)	Yb (ppb)	Lu (ppb)	Hf (ppb)	Ta (ppb)	W (ppb)	Re (ppb)	Os (ppb)	Pt (ppb)	Au (ppb)	Hg (ppb)	Tl (ppb)	Pb (ppb)	Bi (ppb)	Th (ppb)
SW-BPI	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BPI	2	bmdl	bmdl	bmdl	bmdl	bmdl	0.036	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BPI	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BPI	4	bmdl	bmdl	0.066	bmdl	bmdl	bmdl	0.010	bmdl	bmdl	0.031	bmdl	bmdl	2.040	0.176	0.041
SW-BPI	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BKP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BKP	2	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.003
SW-BKP	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BKP	4	bmdl	0.011	0.055	bmdl	bmdl	bmdl	0.010	bmdl	bmdl	bmdl	bmdl	bmdl	1.670	0.180	0.055
SW-BKP	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.028	bmdl	bmdl	3.740	bmdl	bmdl
SW-MB	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-MB	2	bmdl	0.004	bmdl	0.003	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.002
SW-MB	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-MB	4	bmdl	bmdl	0.061	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.049	bmdl	bmdl	1.830	bmdl	0.072
SW-MB	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.021	bmdl	bmdl	bmdl	bmdl	0.014
SW-BYP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BYP	2	bmdl	bmdl	bmdl	0.004	0.001	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.002
SW-BYP	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-BYP	4	bmdl	bmdl	0.057	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.047	bmdl	bmdl	bmdl	0.138	0.093
SW-BYP	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PP	2	0.001	0.007	0.001	bmdl	bmdl	0.020	bmdl	bmdl	bmdl	bmdl	bmdl	0.005	bmdl	bmdl	bmdl
SW-PP	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PP	4	bmdl	bmdl	0.053	bmdl	bmdl	bmdl	0.015	bmdl	bmdl	0.076	bmdl	bmdl	1.830	0.131	0.077
SW-PP	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.026	bmdl	bmdl	1.980	bmdl	bmdl
SW-AR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-AR	2	bmdl	bmdl	0.002	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.219	0.008	bmdl	0.011	0.005
SW-AR	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-AR	4	bmdl	bmdl	bmdl	bmdl	0.022	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	1.700	0.499	bmdl
SW-AR	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.027	bmdl	bmdl	1.160	bmdl	bmdl
SW-PR	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-PR	2	0.001	bmdl	0.010	bmdl	bmdl	0.024	0.005	bmdl	bmdl	bmdl	0.277	0.005	bmdl	0.020	0.003
SW-PR	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-PR	4	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.129	bmdl	bmdl	bmdl	bmdl	0.307	bmdl
SW-PR	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	0.019	bmdl	bmdl	0.021	bmdl	bmdl	4.360	bmdl	0.011
SW-Gulf Stream	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-Gulf Stream	2	bmdl	0.001	bmdl	bmdl	0.001	bmdl	0.002	bmdl	bmdl	bmdl	0.225	0.008	bmdl	bmdl	0.002
SW-Gulf Stream	3	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl
SW-Gulf Stream	4	bmdl	bmdl	bmdl	bmdl	0.012	bmdl	bmdl	bmdl	0.105	bmdl	bmdl	bmdl	bmdl	0.413	0.012
SW-Gulf Stream	5	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl	bmdl

[bmdl, below method detection limit; nd, no data]

Appendix A-2. Surface water hydrochemistry results, Cont.

Location ID	Sampling Round	U (ppb)	DOC (mg/L)	TOC (mg/L)	NO2- (mg/L)	NO3- (mg/L)	NH4+ (mg/L)	DIN (mg/L)	TSN (mg/L)	TN (mg/L)	SRP (mg/L)	TSP (mg/L)	TP (mg/L)	Sol. SiO2 (mg/L)	SO4 (mM)
SW-BPI	1	nd	nd	nd	0.012	0.075	0.108	0.195	0.842	0.873	0.000	0.000	0.003	5.590	2.0
SW-BPI	2	1.790	9.40	9.9	0.001	0.393	0.156	0.550	0.845	nd	0.001	0.004	nd	4.961	nd
SW-BPI	3	1.520	10.00	nd	0.023	0.283	0.243	0.549	0.760	nd	0.002	0.004	nd	5.932	nd
SW-BPI	4	1.930	5.40	nd	0.033	0.417	2.625	3.075	3.144	nd	0.005	0.005	nd	2.203	nd
SW-BPI	5	2.890	6.27	nd	0.001	0.002	0.029	0.032	0.567	nd	0.011	0.014	nd	0.951	nd
SW-BKP	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SW-BKP	2	2.190	6.90	7.4	0.002	0.450	0.101	0.553	0.303	nd	0.001	0.002	nd	3.144	nd
SW-BKP	3	2.010	7.30	nd	0.026	0.607	0.179	0.812	0.917	nd	0.007	0.007	nd	3.326	nd
SW-BKP	4	2.150	5.20	nd	0.026	0.570	0.089	0.685	0.965	nd	0.003	0.005	nd	1.155	nd
SW-BKP	5	3.400	3.83	nd	0.003	0.001	0.010	0.014	0.351	nd	0.010	0.012	nd	0.079	nd
SW-MB	1	nd	nd	nd	0.003	0.015	0.010	0.028	0.174	0.186	0.005	0.005	0.005	0.100	27.4
SW-MB	2	3.110	1.40	1.3	0.002	0.118	0.034	0.154	0.115	nd	0.004	0.006	nd	0.630	nd
SW-MB	3	3.310	2.40	nd	0.004	0.038	0.021	0.063	0.063	nd	0.001	0.018	nd	0.000	nd
SW-MB	4	2.590	2.40	nd	0.003	0.039	0.198	0.240	0.267	nd	0.071	0.071	nd	0.000	nd
SW-MB	5	3.750	1.67	nd	0.004	0.006	0.015	0.025	0.312	nd	0.011	0.013	nd	0.106	nd
SW-BYP	1	nd	nd	nd	0.003	0.017	0.015	0.035	0.156	0.176	0.003	0.005	0.006	0.080	28.9
SW-BYP	2	3.340	1.80	1.8	0.002	0.018	0.009	0.029	0.052	nd	0.005	0.007	nd	0.058	nd
SW-BYP	3	3.320	1.70	nd	0.004	0.035	0.016	0.055	0.055	nd	0.014	0.018	nd	0.000	nd
SW-BYP	4	2.720	1.90	nd	0.002	0.011	0.101	0.114	0.114	nd	0.053	0.053	nd	0.000	nd
SW-BYP	5	3.800	0.74	nd	0.004	0.001	0.000	0.005	0.370	nd	0.013	0.016	nd	0.000	nd
SW-PP	1	nd	nd	nd	0.002	0.000	0.005	0.007	0.083	0.176	0.006	0.006	0.020	0.020	29.6
SW-PP	2	3.540	1.50	1.7	0.002	0.000	0.002	0.004	0.004	nd	0.005	0.007	nd	0.142	nd
SW-PP	3	3.160	2.40	nd	0.002	0.003	0.010	0.015	0.015	nd	0.002	0.017	nd	0.000	nd
SW-PP	4	2.830	1.80	nd	0.002	0.003	0.007	0.012	0.076	nd	0.032	0.032	nd	0.000	nd
SW-PP	5	3.840	1.33	nd	0.004	0.000	0.000	0.004	0.198	nd	0.009	0.014	nd	0.001	nd
SW-AR	1	nd	nd	nd	0.002	0.000	0.002	0.004	0.016	0.026	0.004	0.005	0.006	0.030	29.5
SW-AR	2	4.150	1.00	0.9	0.002	0.000	0.002	0.004	0.003	nd	0.005	0.007	nd	0.056	nd
SW-AR	3	3.750	1.10	nd	0.002	0.002	0.004	0.008	0.008	nd	0.020	0.020	nd	0.000	nd
SW-AR	4	3.400	1.13	nd	0.002	0.002	0.001	0.005	0.005	nd	0.004	0.004	nd	0.000	nd
SW-AR	5	3.640	1.36	nd	0.003	0.001	0.000	0.004	0.004	nd	0.015	0.015	nd	0.019	nd
SW-PR	1	nd	nd	nd	0.002	0.000	0.002	0.004	0.010	0.007	0.006	0.005	0.005	0.000	30.1
SW-PR	2	4.200	0.90	1	0.003	0.000	0.000	0.003	0.003	nd	0.005	0.007	nd	0.078	nd
SW-PR	3	3.640	1.10	nd	0.002	0.003	0.011	0.016	0.016	nd	0.002	0.145	nd	0.000	nd
SW-PR	4	3.100	1.04	nd	0.002	0.001	0.000	0.003	0.003	nd	0.003	0.004	nd	0.000	nd
SW-PR	5	3.660	1.03	nd	0.004	0.000	0.001	0.005	0.087	nd	0.007	0.014	nd	0.017	nd
SW-Gulf Stream	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
SW-Gulf Stream	2	4.160	nd	nd	0.003	0.000	0.000	0.003	nd	nd	0.005	0.007	nd	0.072	nd
SW-Gulf Stream	3	3.660	1.00	nd	0.002	0.005	0.001	0.008	0.008	nd	0.003	0.008	nd	0.000	nd
SW-Gulf Stream	4	3.360	1.04	nd	0.003	0.000	0.001	0.004	0.004	nd	0.007	0.008	nd	0.000	nd
SW-Gulf Stream	5	3.610	1.75	nd	0.003	0.000	0.018	0.021	0.217	nd	0.015	0.015	nd	0.052	nd

[bmdl, below method detection limit; nd, no data]

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb).

Location ID	Location Name	Sample Round	Date	5-Methyl-1H-benzotriazole	Benzo[a]pyrene	Fluoranthene	Phenanthrene
G-3613	Waldin West	1	8/22/02	<2	<0.5	<0.5	<0.5
G-3613	Coconut Palm	2	6/23/03	<2	<0.5	<0.5	<0.5
G-3613	Coconut Palm	3	9/22/03	<2	<0.5	<0.5	<0.5
G-3613	Coconut Palm-West	4	12/17/03	<2	<0.5	<0.5	<0.5
G-3613	Coconut Palm	5	3/31/04	<2	<0.5	<0.5	<0.5
GW-BPI-1A	Black Point Inshore -1A	1	8/22/02	<2	<0.5	<0.5	<0.5
GW-BPI-1A	Black Point Inshore -1A	2	6/24/03	<2	<0.5	<0.5	<0.5
GW-BPI-1A	Black Point Inshore -1A	3	9/24/03	<2	<0.5	<0.5	<0.5
GW-BPI-1A	Black Point Inshore -1A	4	12/17/03	<2	<0.5	<0.5	<0.5
GW-BPI-1A	Black Point Inshore -1A	5	3/31/04	<2	<0.5	<0.5	<0.5
GW-MB-1B	Mid Bay -1B	1	8/22/02	<2	<0.5	<0.5	<0.5
GW-MB-1B	Mid Bay -1B	2	6/24/03	<2	<0.5	<0.5	<0.5
GW-MB-1B	Mid Bay -1B	3	9/24/03	<2	<0.5	<0.5	<0.5
GW-MB-1B	Mid Bay -1B	4	12/15/03	<2	<0.5	<0.5	<0.5
GW-MB-1B	Mid Bay -1B	5	3/29/04	<2	<0.5	<0.5	<0.5
GW-AR-1B	Alina's Reef -1B	1	8/20/02	<2	<0.5	<0.5	<0.5
GW-AR-1B	Alina's Reef -1B	2	6/26/03	<2	<0.5	<0.5	<0.5
GW-AR-1B	Alina's Reef -1B	3	9/23/03	<2	<0.5	<0.5	<0.5
GW-AR-1B	Alina's Reef -1B	4	1/14/04	<2	<0.5	<0.5	<0.5
GW-AR-1B	Alina's Reef -1B	5	3/30/04	<2	<0.5	<0.5	<0.5
BLANK	Field Blank	1	8/22/02	<2	<0.5	<0.5	<0.5
BLANK	Field Blank	2	6/24/03	<2	<0.5	<0.5	<0.5
BLANK	Field Blank	3	9/24/03	<2	<0.5	<0.5	<0.5
BLANK	Field Blank	4	12/17/03	<2	<0.5	<0.5	<0.5
BLANK	Field Blank	5	3/31/04	<2	<0.5	<0.5	<0.5

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Pyrene	4-Cumylphenol	4-n-Octylphenol	4-tert-Octylphenol	OPEO1 (octylphenol, monoethoxy-)
G-3613	1	<0.5	<1	<1	<1	<1
G-3613	2	<0.5	<1	<1	<1	<1
G-3613	3	<0.5	<1	<1	<1	<1
G-3613	4	<0.5	<1	<1	<1	**0.6**
G-3613	5	<0.5	<1	<1	<1	<1
GW-BPI-1A	1	<0.5	<1	<1	<1	<1
GW-BPI-1A	2	<0.5	<1	<1	<1	<1
GW-BPI-1A	3	<0.5	<1	<1	<1	<1
GW-BPI-1A	4	<0.5	<1	<1	<1	**0.7**
GW-BPI-1A	5	<0.5	<1	<1	<1	<1
GW-MB-1B	1	<0.5	<1	<1	<1	<1
GW-MB-1B	2	<0.5	<1	<1	<1	<1
GW-MB-1B	3	<0.5	<1	<1	<1	<1
GW-MB-1B	4	<0.5	<1	<1	<1	**0.6**
GW-MB-1B	5	<0.5	<1	<1	<1	<1
GW-AR-1B	1	<0.5	<1	<1	<1	<1
GW-AR-1B	2	<0.5	<1	<1	<1	<1
GW-AR-1B	3	<0.5	<1	<1	<1	<1
GW-AR-1B	4	<0.5	<1	<1	<1	<1
GW-AR-1B	5	<0.5	<1	<1	<1	<1
Field Blank	1	<0.5	<1	<1	<1	<1
Field Blank	2	<0.5	<1	<1	<1	<1
Field Blank	3	<0.5	<1	<1	<1	<1
Field Blank	4	<0.5	<1	<1	<1	**0.68**
Field Blank	5	<0.5	<1	<1	<1	<1

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	OPEO2 (octylphenol, diethoxy-)	total, NP(para-nonylphenol)	total, NPEO2 (nonylphenol, diethoxy-)	Bisphenol A
G-3613	1	<1	**8.7**	<0.5	<1
G-3613	2	<1	<5	<0.5	<1
G-3613	3	<1	<5	<0.5	<1
G-3613	4	<1	<5	<0.5	<1
G-3613	5	<1	<5	<0.5	<1
GW-BPI-1A	1	<1	**7.2**	<0.5	<1
GW-BPI-1A	2	**0.092**	<5	<0.5	<1
GW-BPI-1A	3	<1	<5	<0.5	<1
GW-BPI-1A	4	<1	<5	<0.5	<1
GW-BPI-1A	5	<1	**0.64**	<0.5	<1
GW-MB-1B	1	<1	<5	<0.5	<1
GW-MB-1B	2	<1	<5	<0.5	**0.25**
GW-MB-1B	3	<1	<5	<0.5	<1
GW-MB-1B	4	<1	<5	<0.5	<1
GW-MB-1B	5	<1	<5	<0.5	<1
GW-AR-1B	1	<1	**5.4**	<0.5	<1
GW-AR-1B	2	<1	<5	<0.5	<1
GW-AR-1B	3	<1	<5	<0.5	<1
GW-AR-1B	4	<1	<5	<0.5	<1
GW-AR-1B	5	<1	<5	<0.5	<1
BLANK	1	<1	<5	<0.5	<1
BLANK	2	<1	**5.9**	<0.5	<1
BLANK	3	<1	<5	<0.5	<1
BLANK	4	<1	**1.4**	<0.5	<1
BLANK	5	<1	**0.84**	<0.5	<1

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Tri(2-butoxyethyl)-phosphate	Tri(dichloroisoprophyl) phosphate	Tributyl phosphate	1-Methylnaphthalene
G-3613	1	<0.5	<0.5	<0.5	<0.5
G-3613	2	<0.5	<0.5	<0.5	<0.5
G-3613	3	<0.5	<0.5	<0.5	<0.5
G-3613	4	<0.5	<0.5	<0.5	<0.5
G-3613	5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	1	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	2	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	3	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	4	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	1	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	2	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	3	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	4	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	1	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	2	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	3	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	4	**0.15**	<0.5	<0.5	<0.5
GW-AR-1B	5	<0.5	<0.5	<0.5	<0.5
Field Blank	1	<0.5	<0.5	<0.5	<0.5
Field Blank	2	<0.5	<0.5	<0.5	<0.5
Field Blank	3	<0.5	<0.5	<0.5	<0.5
Field Blank	4	<0.5	<0.5	<0.5	<0.5
Field Blank	5	<0.5	<0.5	<0.5	<0.5

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	2,6-Dimethylnaphthalene	2-Methylnaphthalene	Naphthalene	d-Limonene	Bromacil	Metalaxyl	Metolachlor	Prometon
G-3613	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.052**	**0.14**
GW-BPI-1A	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	1	**0.14**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	2	<0.5	<0.5	**0.11**	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	3	<0.5	<0.5	**0.079**	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	5	<0.5	<0.5	**0.036**	<0.5	<0.5	<0.5	<0.5	<0.5

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Carbazole	Carbaryl	Chlorpyrifos	Diazinon	Dichlorvos	Acetophenone	Anthraquinone	Benzophenone
G-3613	1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
G-3613	2	<0.5	<1	<0.5	<0.5	<1	**0.1**	<0.5	<0.5
G-3613	3	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
G-3613	4	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
G-3613	5	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-BPI-1A	1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-BPI-1A	2	<0.5	<1	<0.5	<0.5	<1	**0.18**	<0.5	<0.5
GW-BPI-1A	3	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-BPI-1A	4	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-BPI-1A	5	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-MB-1B	1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-MB-1B	2	<0.5	<1	<0.5	<0.5	<1	**0.12**	<0.5	<0.5
GW-MB-1B	3	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-MB-1B	4	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-MB-1B	5	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-AR-1B	1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-AR-1B	2	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-AR-1B	3	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-AR-1B	4	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
GW-AR-1B	5	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
Field Blank	1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
Field Blank	2	<0.5	<1	<0.5	<0.5	<1	**3.9**	<0.5	<0.5
Field Blank	3	<0.5	<1	<0.5	<0.5	<1	**7.1**	<0.5	<0.5
Field Blank	4	<0.5	<1	<0.5	<0.5	<1	**4.2**	<0.5	<0.5
Field Blank	5	<0.5	<1	<0.5	<0.5	<1	**6**	<0.5	**0.023**

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	BHA (3-tert-Butyl-4-hydroxyanisole)	Caffeine	Camphor	Cotinine	DEET (N,N-diethyl-meta-toluamide)	1,4-Dichlorobenzene
G-3613	1	<5	<0.5	<0.5	<1	**0.1**	<0.5
G-3613	2	<5	<0.5	<0.5	<1	**0.12**	<0.5
G-3613	3	<5	<0.5	<0.5	<1	**0.2**	<0.5
G-3613	4	<5	<0.5	<0.5	<1	<0.5	<0.5
G-3613	5	<5	<0.5	<0.5	<1	**0.015**	<0.5
GW-BPI-1A	1	<5	<0.5	<0.5	<1	**0.04**	<0.5
GW-BPI-1A	2	<5	<0.5	<0.5	<1	**0.18**	<0.5
GW-BPI-1A	3	<5	<0.5	<0.5	<1	**0.14**	<0.5
GW-BPI-1A	4	<5	<0.5	<0.5	<1	<0.5	<0.5
GW-BPI-1A	5	<5	<0.5	<0.5	<1	**0.067**	<0.5
GW-MB-1B	1	<5	<0.5	<0.5	<1	<0.5	<0.5
GW-MB-1B	2	<5	<0.5	<0.5	<1	**0.12**	<0.5
GW-MB-1B	3	<5	<0.5	<0.5	<1	**0.33**	<0.5
GW-MB-1B	4	<5	<0.5	<0.5	<1	<0.5	<0.5
GW-MB-1B	5	<5	<0.5	<0.5	<1	**0.018**	<0.5
GW-AR-1B	1	<5	<0.5	<0.5	<1	**0.02**	<0.5
GW-AR-1B	2	<5	<0.5	<0.5	<1	**0.21**	<0.5
GW-AR-1B	3	<5	<0.5	<0.5	<1	**0.14**	<0.5
GW-AR-1B	4	<5	<0.5	<0.5	<1	**0.056**	**0.062**
GW-AR-1B	5	<5	<0.5	<0.5	<1	**0.033**	<0.5
Field Blank	1	<5	<0.5	<0.5	<1	**0.02**	<0.5
Field Blank	2	<5	<0.5	<0.5	<1	**0.23**	<0.5
Field Blank	3	<5	<0.5	<0.5	<1	**0.31**	<0.5
Field Blank	4	<5	<0.5	<0.5	<1	**0.17**	<0.5
Field Blank	5	<5	<0.5	<0.5	<1	**0.22**	<0.5

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Galoxide, HHCB (hexahydrohexamethyl-	Indole	Isoborneol	Isoquinoline	Menthol	Methyl salicylate	Phenol
G-3613	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.33**
G-3613	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
G-3613	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.53**
GW-BPI-1A	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.47**
GW-BPI-1A	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-BPI-1A	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.2**
GW-MB-1B	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.33**
GW-MB-1B	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-MB-1B	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.33**
GW-AR-1B	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW-AR-1B	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.46**
GW-AR-1B	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.23**
Field Blank	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.79**
Field Blank	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.83**
Field Blank	5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.034**	**0.53**

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Skatol	Tonalide, AHTN (acetyl-hexamethyl-	Triclosan	Triethyl citrate (ethyl citrate)	Tri(2-chloroethyl) phosphate
G-3613	1	<1	<0.5	<1	<0.5	<0.5
G-3613	2	<1	<0.5	<1	<0.5	<0.5
G-3613	3	<1	<0.5	<1	<0.5	<0.5
G-3613	4	<1	<0.5	<1	<0.5	<0.5
G-3613	5	<1	<0.5	<1	<0.5	<0.5
GW-BPI-1A	1	<1	<0.5	<1	<0.5	<0.5
GW-BPI-1A	2	<1	<0.5	<1	<0.5	<0.5
GW-BPI-1A	3	<1	<0.5	<1	<0.5	<0.5
GW-BPI-1A	4	<1	<0.5	<1	<0.5	<0.5
GW-BPI-1A	5	<1	<0.5	<1	<0.5	<0.5
GW-MB-1B	1	<1	<0.5	<1	<0.5	<0.5
GW-MB-1B	2	<1	<0.5	<1	<0.5	<0.5
GW-MB-1B	3	<1	<0.5	<1	<0.5	<0.5
GW-MB-1B	4	<1	<0.5	<1	<0.5	<0.5
GW-MB-1B	5	<1	<0.5	<1	<0.5	<0.5
GW-AR-1B	1	<1	<0.5	<1	<0.5	<0.5
GW-AR-1B	2	<1	<0.5	<1	<0.5	<0.5
GW-AR-1B	3	<1	<0.5	<1	<0.5	<0.5
GW-AR-1B	4	<1	<0.5	<1	<0.5	<0.5
GW-AR-1B	5	<1	<0.5	<1	<0.5	<0.5
Field Blank	1	<1	<0.5	<1	<0.5	<0.5
Field Blank	2	<1	<0.5	<1	<0.5	<0.5
Field Blank	3	<1	<0.5	<1	<0.5	<0.5
Field Blank	4	<1	<0.5	<1	<0.5	<0.5
Field Blank	5	<1	<0.5	<1	<0.5	<0.5

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Triphenyl phosphate	Isophorone	Cumene (isopropylbenzene)	Tetrachloroethylene	Estrone	Equilenin
G-3613	1	<0.5	<0.5	<0.5	<0.5	<5	<5
G-3613	2	<0.5	<0.5	<0.5	<0.5	<5	<5
G-3613	3	<0.5	<0.5	<0.5	<0.5	<5	<5
G-3613	4	<0.5	<0.5	<0.5	<0.5	<5	<5
G-3613	5	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-BPI-1A	1	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-BPI-1A	2	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-BPI-1A	3	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-BPI-1A	4	<0.5	<0.5	<0.5	<0.5	**0.4**	<5
GW-BPI-1A	5	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-MB-1B	1	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-MB-1B	2	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-MB-1B	3	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-MB-1B	4	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-MB-1B	5	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-AR-1B	1	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-AR-1B	2	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-AR-1B	3	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-AR-1B	4	<0.5	<0.5	<0.5	<0.5	<5	<5
GW-AR-1B	5	<0.5	<0.5	<0.5	<0.5	<5	<5
Field Blank	1	<0.5	<0.5	<0.5	<0.5	<5	<5
Field Blank	2	<0.5	<0.5	<0.5	<0.5	<5	<5
Field Blank	3	<0.5	<0.5	<0.5	<0.5	<5	<5
Field Blank	4	<0.5	<0.5	<0.5	<0.5	<5	<5
Field Blank	5	<0.5	<0.5	<0.5	<0.5	<5	<5

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	17alpha-ethynyl estradiol	17beta-Estradiol	3beta-Coprostanol	beta-Sitosterol	beta-Stigmastanol	Cholesterol	Bromoform
G-3613	1	<5	<5	<2	<2	<2	<2	<0.5
G-3613	2	<5	<5	<2	<2	<2	<2	<0.5
G-3613	3	<5	<5	<2	<2	<2	<2	<0.5
G-3613	4	<5	<5	<2	<2	<2	<2	<0.5
G-3613	5	<5	<5	<2	<2	<2	<2	<0.5
GW-BPI-1A	1	<5	<5	<2	<2	<2	<2	**0.01**
GW-BPI-1A	2	<5	<5	<2	<2	<2	<2	<0.5
GW-BPI-1A	3	<5	<5	<2	<2	<2	<2	**0.044**
GW-BPI-1A	4	<5	<5	<2	<2	<2	<2	<0.5
GW-BPI-1A	5	<5	<5	<2	<2	<2	<2	**0.017**
GW-MB-1B	1	<5	<5	<2	<2	<2	<2	<0.5
GW-MB-1B	2	<5	<5	<2	<2	<2	<2	<0.5
GW-MB-1B	3	<5	<5	<2	<2	<2	<2	**0.11**
GW-MB-1B	4	<5	<5	<2	<2	<2	<2	<0.5
GW-MB-1B	5	<5	<5	<2	<2	<2	<2	**0.017**
GW-AR-1B	1	<5	<5	<2	<2	<2	<2	<0.5
GW-AR-1B	2	<5	<5	<2	<2	<2	<2	<0.5
GW-AR-1B	3	<5	<5	<2	<2	<2	<2	<0.5
GW-AR-1B	4	<5	<5	<2	<2	<2	<2	<0.5
GW-AR-1B	5	<5	<5	<2	<2	<2	<2	<0.5
Field Blank	1	<5	<5	<2	<2	<2	<2	**0.03**
Field Blank	2	<5	<5	<2	<2	<2	<2	<0.5
Field Blank	3	<5	<5	<2	<2	<2	<2	<0.5
Field Blank	4	<5	<5	<2	<2	<2	<2	<0.5
Field Blank	5	<5	<5	<2	<2	<2	<2	**0.012**

Appendix A-3. Groundwater results for wastewater compounds. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Anthracene	para-Cresol	Pentachlorophenol
G-3613	1	<0.5	<1	<2
G-3613	2	<0.5	<1	<2
G-3613	3	<0.5	<1	<2
G-3613	4	<0.5	<1	<2
G-3613	5	<0.5	<1	<2
GW-BPI-1A	1	<0.5	<1	<2
GW-BPI-1A	2	<0.5	<1	<2
GW-BPI-1A	3	<0.5	<1	<2
GW-BPI-1A	4	<0.5	<1	<2
GW-BPI-1A	5	<0.5	<1	<2
GW-MB-1B	1	<0.5	<1	<2
GW-MB-1B	2	<0.5	<1	<2
GW-MB-1B	3	<0.5	<1	<2
GW-MB-1B	4	<0.5	<1	<2
GW-MB-1B	5	<0.5	**0.052**	<2
GW-AR-1B	1	<0.5	<1	<2
GW-AR-1B	2	<0.5	<1	<2
GW-AR-1B	3	<0.5	<1	<2
GW-AR-1B	4	<0.5	<1	<2
GW-AR-1B	5	<0.5	<1	<2
Field Blank	1	<0.5	<1	<2
Field Blank	2	<0.5	<1	<2
Field Blank	3	<0.5	<1	<2
Field Blank	4	<0.5	<1	<2
Field Blank	5	<0.5	<1	<2

Appendix A-4. Wastewater compounds for surface-water sites. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb).

Location ID	Location Name	Sample Round	Date	Latitude (N)	Longitude (W)	5-Methyl-1H-benzotriazole	Benzo[a]pyrene	Fluoranthene
SW-BPI	Black Point Inshore	1	8/22/02	25.526	-80.330	<2	<0.5	<0.5
SW-BPI	Black Point Inshore	2	6/24/03	25.526	-80.330	<2	<0.5	<0.5
SW-BPI	Black Point Inshore	3	9/24/03	25.526	-80.330	<2	<0.5	<0.5
SW-BPI	Black Point Inshore	4	1/14/04	25.526	-80.330	<2	<0.5	<0.5
SW-BPI	Black Point Inshore	5	3/30/04	25.526	-80.330	<2	<0.5	<0.5
SW-Gulf Stream	Gulf Stream	1		no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	Gulf Stream	2	6/25/03	25.377	-80.132	<2	<0.5	<0.5
SW-Gulf Stream	Gulf Stream	3	9/23/03	25.377	-80.132	<2	<0.5	<0.5
SW-Gulf Stream	Gulf Stream	4	1/14/04	25.377	-80.132	<2	<0.5	<0.5
SW-Gulf Stream	Gulf Stream	5	3/30/04	25.377	-80.132	<2	<0.5	<0.5

Location ID	Sample Round	Phenanthrene	Pyrene	4-Cumylphenol	4-n-Octylphenol	4-tert-Octylphenol	OPEO1 (octylphenol, monoethoxy-)
SW-BPI	1	<0.5	<0.5	<1	<1	<1	<1
SW-BPI	2	<0.5	<0.5	<1	<1	<1	<1
SW-BPI	3	<0.5	<0.5	<1	<1	<1	<1
SW-BPI	4	<0.5	<0.5	<1	<1	<1	**0.6**
SW-BPI	5	<0.5	<0.5	<1	<1	<1	<1
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	<0.5	<1	<1	<1	<1
SW-Gulf Stream	3	<0.5	<0.5	<1	<1	<1	<1
SW-Gulf Stream	4	<0.5	<0.5	<1	<1	<1	<1
SW-Gulf Stream	5	<0.5	<0.5	<1	<1	<1	<1

Location ID	Sample Round	OPEO2 (octylphenol, diethoxy-)	total, NP(para-nonylphenol)	total, NPEO2 (nonylphenol, diethoxy-)	Bisphenol A
SW-BPI	1	<1	**12**	<0.5	<1
SW-BPI	2	**0.098**	<5	<0.5	<1
SW-BPI	3	<1	<5	<0.5	<1
SW-BPI	4	<1	<5	<0.5	<1
SW-BPI	5	<1	**0.76**	<0.5	<1
SW-Gulf Stream	1	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<1	<5	<0.5	<1
SW-Gulf Stream	3	<1	<5	<0.5	<1
SW-Gulf Stream	4	<1	<5	<0.5	<1
SW-Gulf Stream	5	<1	<5	<0.5	<1

Appendix A-4. Wastewater compounds for surface-water sites. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Tri(2-butoxyethyl)-phosphate	Tri(dichloroisoprophyl) phosphate	Tributyl phosphate	1-Methylnaphthalene
SW-BPI	1	<0.5	<0.5	<0.5	<0.5
SW-BPI	2	<0.5	<0.5	<0.5	**0.25**
SW-BPI	3	<0.5	<0.5	<0.5	<0.5
SW-BPI	4	<0.5	<0.5	<0.5	<0.5
SW-BPI	5	<0.5	<0.5	<0.5	**0.03**
SW-Gulf Stream	1	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	3	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	4	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	5	<0.5	<0.5	<0.5	<0.5

Location ID	Sample Round	2,6-Dimethylnaphthalene	2-Methylnaphthalene	Naphthalene	d-Limonene	Bromacil	Metalaxyl	Metolachlor	Prometon
SW-BPI	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	2	**0.047**	**0.5**	**0.7**	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	4	<0.5	<0.5	**0.1**	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	5	<0.5	**0.047**	**0.099**	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Location ID	Sample Round	Carbazole	Carbaryl	Chlorpyrifos	Diazinon	Dichlorvos	Acetophenone	Anthraquinone	Benzophenone
SW-BPI	1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
SW-BPI	2	**0.021**	<1	<0.5	<0.5	<1	**0.34**	<0.5	<0.5
SW-BPI	3	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
SW-BPI	4	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
SW-BPI	5	<0.5	<1	<0.5	<0.5	<1	**0.11**	<0.5	<0.5
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	<1	<0.5	<0.5	<1	**0.1**	<0.5	<0.5
SW-Gulf Stream	3	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5
SW-Gulf Stream	4	<0.5	<1	<0.5	<0.5	<1	**0.13**	<0.5	<0.5
SW-Gulf Stream	5	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<0.5

Appendix A-4. Wastewater compounds for surface-water sites. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	BHA (3-tert-Butyl-4-hydroxyanisole)	Caffeine	Camphor	Cotinine	DEET (N,N-diethyl-meta-toluamide)
SW-BPI	1	<5	<0.5	<0.5	<1	**0.07**
SW-BPI	2	<5	<0.5	<0.5	<1	**0.59**
SW-BPI	3	<5	<0.5	<0.5	<1	**0.15**
SW-BPI	4	<5	<0.5	<0.5	<1	**0.09**
SW-BPI	5	<5	**0.044**	<0.5	<1	**0.067**
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<5	<0.5	<0.5	<1	**0.16**
SW-Gulf Stream	3	<5	<0.5	<0.5	<1	**0.22**
SW-Gulf Stream	4	<5	<0.5	<0.5	<1	**0.066**
SW-Gulf Stream	5	<5	<0.5	<0.5	<1	**0.027**

Location ID	Sample Round	1,4-Dichlorobenzene	Galoxide, HHCB (hexahydrohexamethyl-	Indole	Isoborneol	Isoquinoline	Menthol
SW-BPI	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-BPI	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-Gulf Stream	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Location ID	Sample Round	Methyl salicylate	Phenol	Skatol	Tonalide, AHTN (acetyl-hexamethyl-	Triclosan	Triethyl citrate (ethyl citrate)
SW-BPI	1	<0.5	<0.5	<1	<0.5	<1	<0.5
SW-BPI	2	<0.5	<0.5	<1	<0.5	<1	<0.5
SW-BPI	3	<0.5	<0.5	<1	<0.5	<1	<0.5
SW-BPI	4	<0.5	<0.5	<1	<0.5	<1	<0.5
SW-BPI	5	<0.5	**0.19**	<1	<0.5	<1	<0.5
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	**0.64**	<1	<0.5	<1	<0.5
SW-Gulf Stream	3	<0.5	<0.5	<1	<0.5	<1	<0.5
SW-Gulf Stream	4	<0.5	<0.5	<1	<0.5	<1	<0.5
SW-Gulf Stream	5	<0.5	**0.2**	<1	<0.5	<1	<0.5

Appendix A-4. Wastewater compounds for surface-water sites. Numbers (bold) below method detection limits (MDL; i.e. <5) were detected on the GC-MS but were reported as an estimated number. Values in ug/L (ppb), Cont.

Location ID	Sample Round	Tri(2-chloroethyl) phosphate	Triphenyl phosphate	Isophorone	Cumene (isopropylbenzene)	Tetrachloroethylene	Estrone
SW-BPI	1	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-BPI	2	<0.5	<0.5	<0.5	**0.044**	<0.5	<5
SW-BPI	3	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-BPI	4	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-BPI	5	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-Gulf Stream	3	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-Gulf Stream	4	<0.5	<0.5	<0.5	<0.5	<0.5	<5
SW-Gulf Stream	5	<0.5	<0.5	<0.5	<0.5	<0.5	<5

Location ID	Sample Round	Equilenin	17alpha-ethynyl estradiol	17beta-Estradiol	3beta-Coprostanol	beta-Sitosterol	beta-Stigmastanol
SW-BPI	1	<5	<5	<5	<2	<2	<2
SW-BPI	2	<5	<5	<5	<2	<2	<2
SW-BPI	3	<5	<5	<5	<2	<2	<2
SW-BPI	4	<5	<5	<5	<2	<2	<2
SW-BPI	5	<5	<5	<5	<2	<2	<2
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<5	<5	<5	<2	<2	<2
SW-Gulf Stream	3	<5	<5	<5	<2	<2	<2
SW-Gulf Stream	4	<5	<5	<5	<2	<2	<2
SW-Gulf Stream	5	<5	<5	<5	<2	<2	<2

Location ID	Sample Round	Cholesterol	Bromoform	Anthracene	para-Cresol	Pentachlorophenol
SW-BPI	1	<2	<0.5	<0.5	<1	<2
SW-BPI	2	<2	**0.1**	<0.5	**0.14**	<2
SW-BPI	3	<2	**0.87**	<0.5	<1	<2
SW-BPI	4	<2	**0.22**	<0.5	<1	<2
SW-BPI	5	<2	<0.5	<0.5	**0.05**	<2
SW-Gulf Stream	1	no sample	no sample	no sample	no sample	no sample
SW-Gulf Stream	2	<2	<0.5	<0.5	<1	<2
SW-Gulf Stream	3	<2	<0.5	<0.5	<1	<2
SW-Gulf Stream	4	<2	<0.5	<0.5	<1	<2
SW-Gulf Stream	5	<2	<0.5	<0.5	<1	<2

Appendix A-5. Radium and radon isotope data for August 2002 and June 2003.

Station Name	Sample Location	Latitude N	Longitude W	Date	^{223}Ra (dpm/100L)	^{224}Ra (dpm/100L)	$^{223/224}$Ra (dpm/100L)	^{222}Rn (dpm/L)
Waldin West	G-3615 GW	25.500	-80.386	Aug-02	ns	ns	ns	940.00
Coconut Palm	G-3613 GW	25.537	-80.365	Jun-03	183.9539	701.1389	0.2624	ns
Black Point Inshore	BPI-1A GW	25.526	-80.330	Aug-02	87.4246	174.9620	0.4997	100.00
Black Point Inshore	BPI-1A GW	25.526	-80.330	Jun-03	146.2576	282.2963	0.5181	ns
Black Point	BkP-1A GW	25.526	-80.324	Aug-02	ns	ns	ns	ns
Black Point	BkP-1A GW	25.526	-80.324	Jun-03	205.6494	442.1031	0.4652	ns
Mid Bay -1B	MB-1B GW	25.484	-80.267	Aug-02	134.2317	372.9585	0.3599	310.00
Mid Bay -1B	MB-1B GW	25.484	-80.267	Jun-03	59.7298	95.5452	0.6251	ns
Billy's Point -1A	ByP-1A GW	25.428	-80.212	Aug-02	148.7208	396.0486	0.3755	ns
Billy's Point -1A	ByP-1A GW	25.428	-80.212	Jun-03	350.9743	871.6261	0.4027	ns
Petrel Point -1A	PP-1A GW	25.415	-80.204	Aug-02	171.2744	424.6765	0.4033	230.00
Petrel Point -1A	PP-1A GW	25.415	-80.204	Jun-03	243.3771	239.0409	1.0181	ns
Alina's Reef -1A	AR-1A GW	25.386	-80.163	Aug-02	12.1096	204.1080	0.0593	390.00
Alina's Reef -1A	AR-1A GW	25.386	-80.163	Jun-03	223.4845	147.9601	1.5104	ns
Pacific Reef -1A	PR-1A GW	25.371	-80.142	Aug-02	128.0227	155.2491	0.8246	250.00
Pacific Reef -1A	PR-1A GW	25.371	-80.142	Jun-03	114.7479	49.4262	2.3216	ns
Black Point Inshore	BPI-SW	25.526	-80.330	Aug-02	2.5790	3.4504	0.7475	ns
Black Point Inshore	BPI-SW	25.526	-80.330	Jun-03	17.0601	42.3151	0.4032	ns
Black Point	BkP-SW	25.526	-80.324	Aug-02	ns	ns	ns	ns
Black Point	BkP-SW	25.526	-80.324	Jun-03	8.9059	13.4043	0.6644	ns
Mid Bay	MB-SW	25.484	-80.267	Aug-02	6.4150	14.1839	0.4523	ns
Mid Bay	MB-SW	25.484	-80.267	Jun-03	7.9897	6.0647	1.3174	ns
Billy's Point	ByP-SW	25.428	-80.212	Aug-02	0.1990	1.6618	0.1197	ns
Billy's Point	ByP-SW	25.428	-80.212	Jun-03	3.5900	9.5784	0.3748	ns
Petrel Point	PP-SW	25.415	-80.204	Aug-02	0.8638	3.7956	0.2276	ns
Petrel Point	PP-SW	25.415	-80.204	Jun-03	1.1018	4.3289	0.2545	ns
Alina's Reef	AR-SW	25.386	-80.163	Aug-02	ns	ns	ns	ns
Alina's Reef	AR-SW	25.386	-80.163	Jun-03	0.4784	9.0291	0.0530	ns
Pacific Reef	PR-SW	25.371	-80.142	Aug-02	0.0426	1.0562	0.0404	ns
Pacific Reef	PR-SW	25.371	-80.142	Jun-03	0.1066	1.1217	0.0950	ns

note: half lives are: ^{223}Ra = 11.4 days; ^{224}Ra = 3.7 days; ^{222}Rn = 3.8 days; ns = no sample

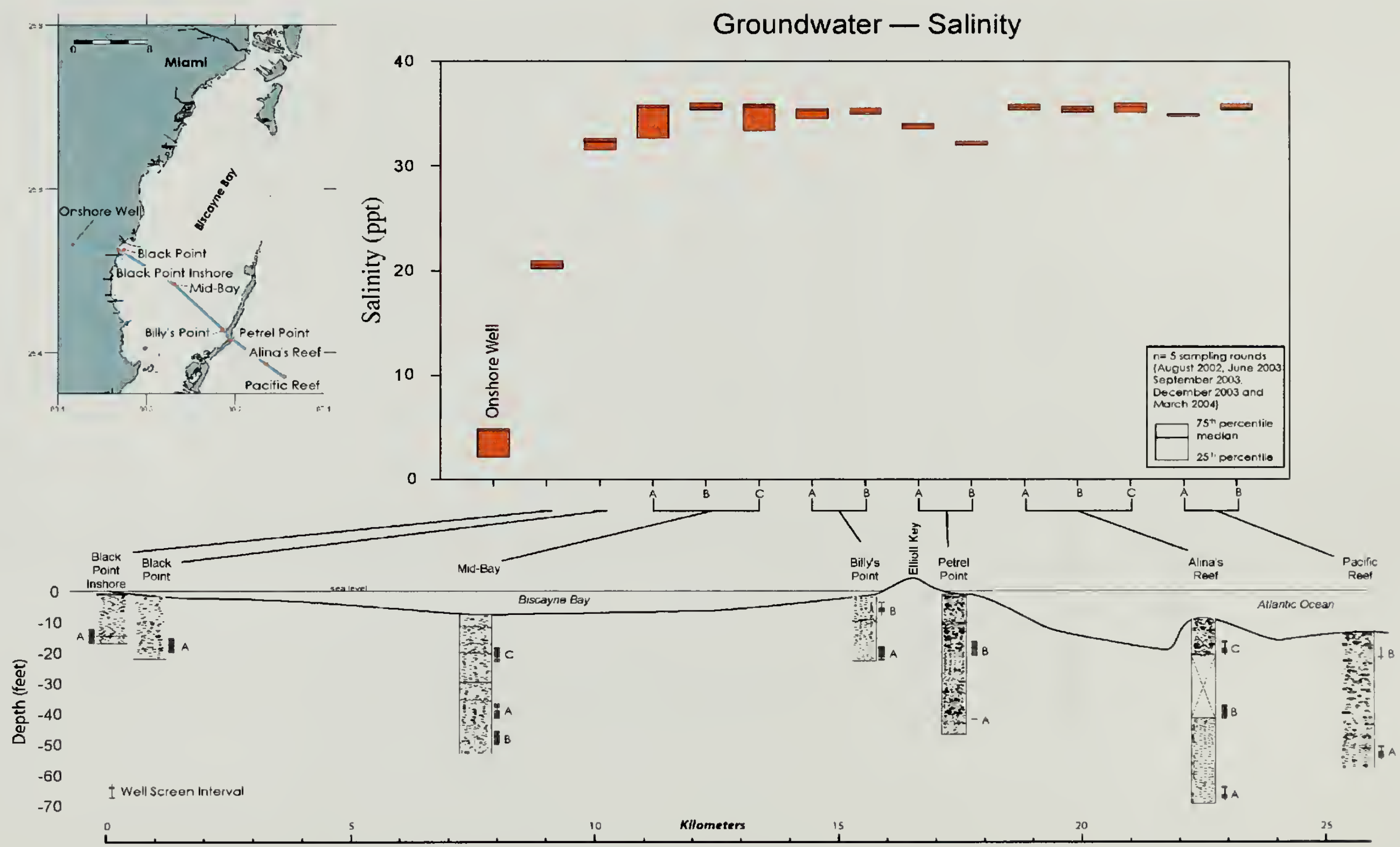
Appendix A-6. Strontium-isotope and salinity data for August 2002 and March 2003 sampling rounds.

					August 2002[1]			March 2004[2]		
Location Name	GW/SW Sample	Location ID	Latitude	Longitude	Salinity	$^{87/86}Sr$	% SdErr 87/86	Salinity	$^{87/86}Sr$	% SdErr 87/86
Black Point Inshore	SW	BPI-SW	25.526	-80.330	2.8	0.709130	0.0008	31.12	ns	ns
Mid Bay	SW	MB-SW	25.484	-80.267	36.0	0.709162	0.0010	36.30	ns	ns
Billy's Point	SW	SW-BYP	25.428	-80.212	35.1	0.709163	0.0007	37.10	ns	ns
Petrel Point	SW	PP-SW	25.415	-80.204	36.2	0.709171	0.0008	36.10	ns	ns
Alina's Reef	SW	AR-SW	25.386	-80.163	36.0	0.709162	0.0009	35.70	ns	ns
Pacific Reef	SW	PR-SW	25.371	-80.142	35.6	0.709147	0.0009	35.60	ns	ns
G-3613	GW	GW-3615	25.537	-80.365	5.0	0.709115	0.0010	4.00	0.709155	0.000009
Black Point Inshore	GW	BPI-1A-GW	25.526	-80.330	21.2	0.709161	0.0009	20.00	0.709166	0.000009
Mid Bay	GW	MB-1A-GW	25.484	-80.267	36.0	0.709147	0.0010	35.60	0.709157	0.000009
Billy's Point	GW	BYP-1A-GW	25.428	-80.212	34.3	0.709166	0.0009	35.50	ns	ns
Petrel Point	GW	PP-1B-GW	25.415	-80.204	34.3	0.709152	0.0009	33.90	0.709172	0.000007
Alina's Reef	GW	AR-1A-GW	25.386	-80.163	36.1	0.709152	0.0009	35.60	0.709160	0.000007
Pacific Reef	GW	PR-1A-GW	25.371	-80.142	34.9	0.709139	0.0008	34.80	ns	ns
Elliott Key (UFA)	GW	EKH-UFA	25.451	-80.196	ns	ns	ns	2.00	0.708236	0.000010

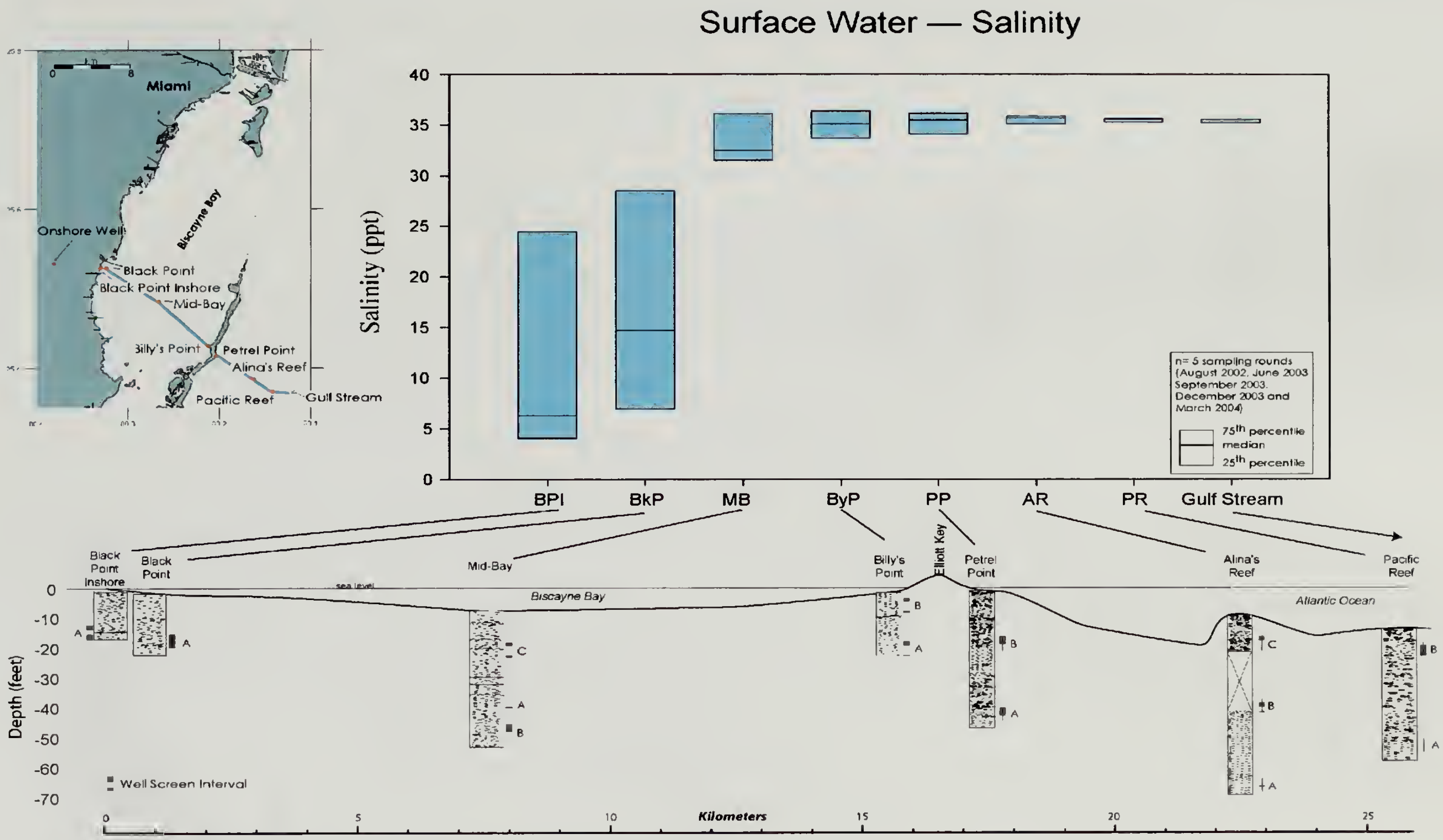
[1]Analyses by University of Florida; [2]Analyses by Geochron-Krueger Laboratory; ns=no sample for $^{87/86}Sr$; units of 87/86Sr is permil

Appendix B1 – B3

Hydrochemistry Graphs



Appendix B1. Field parameters for ground and surface waters in BNP.



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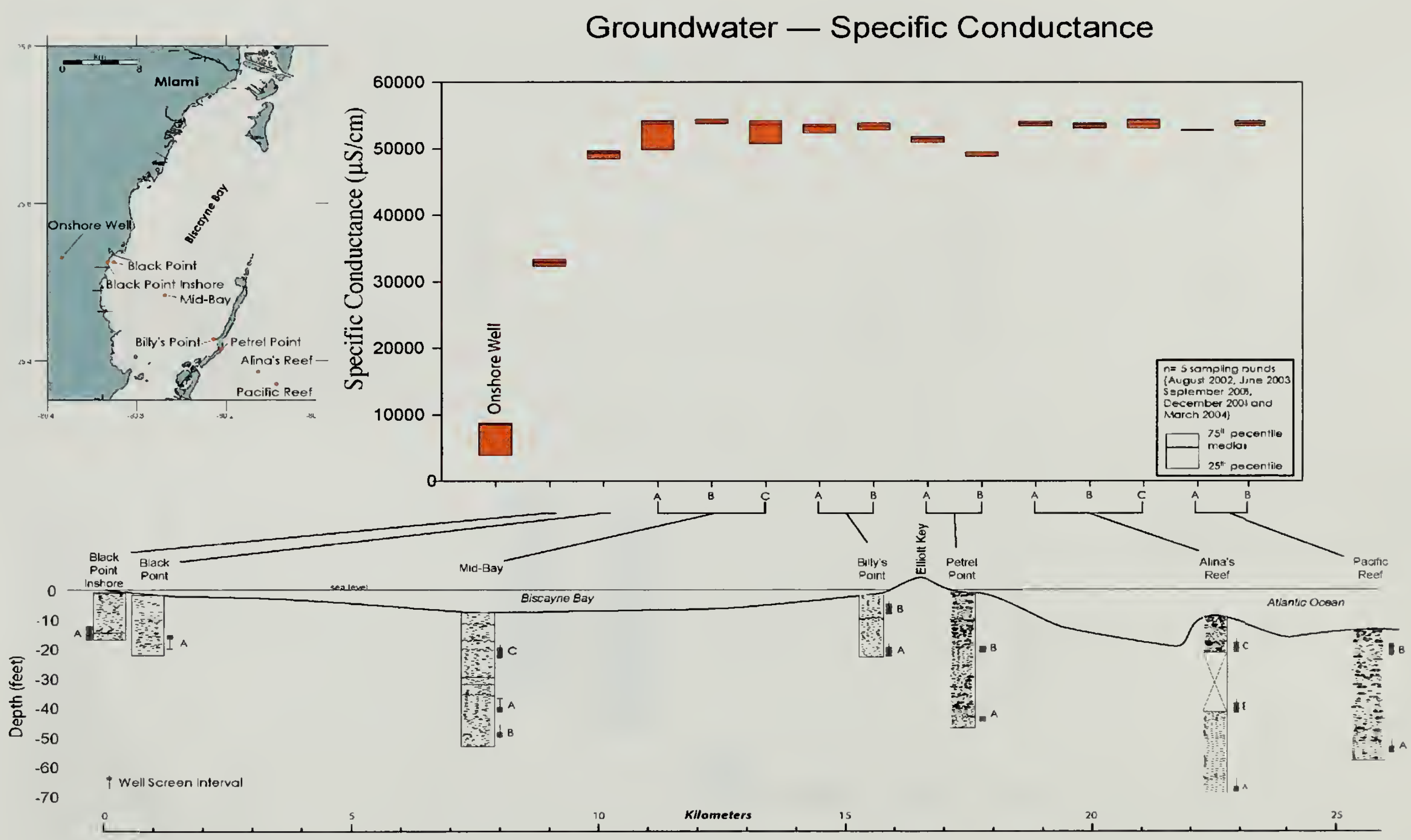

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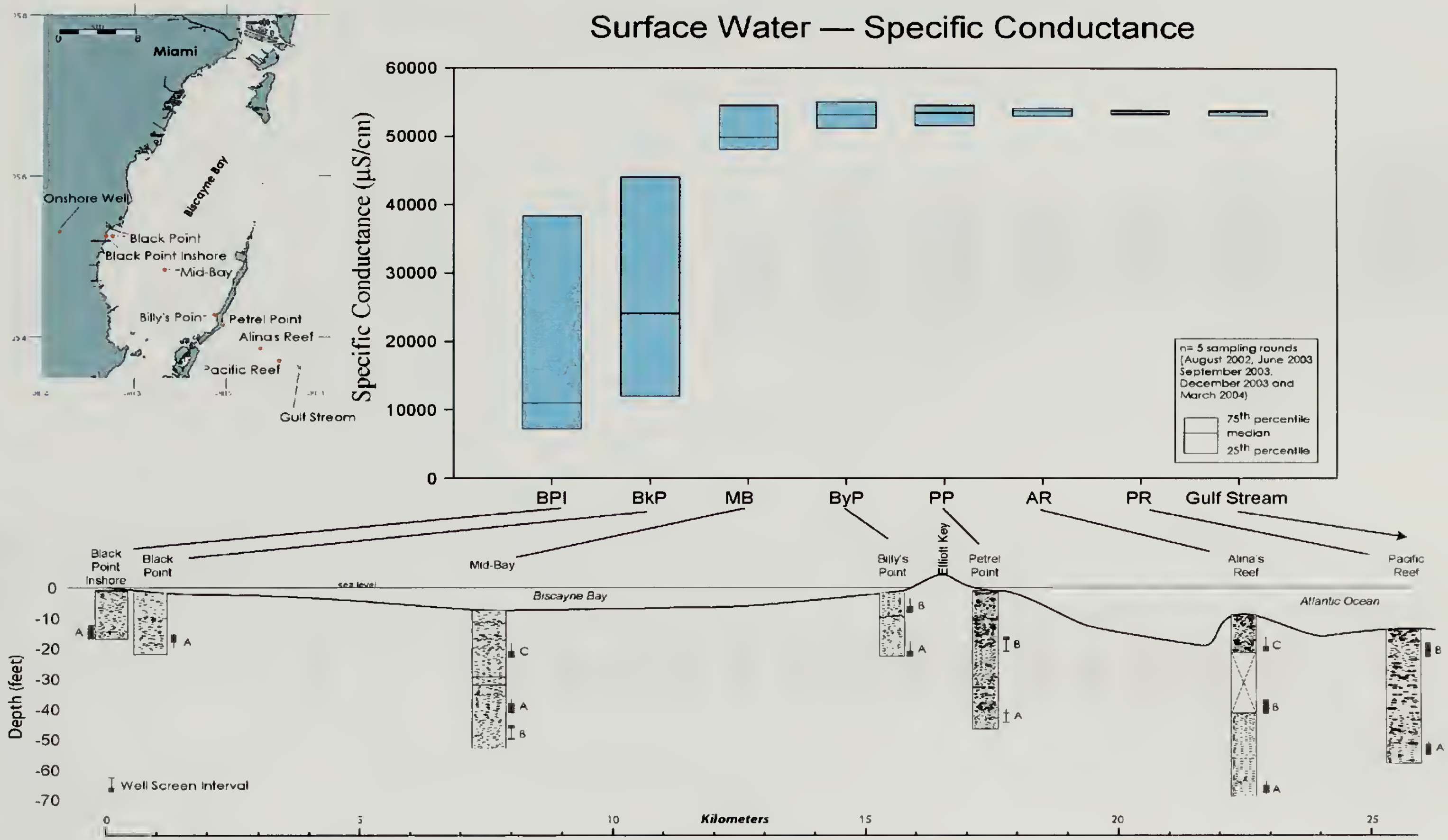

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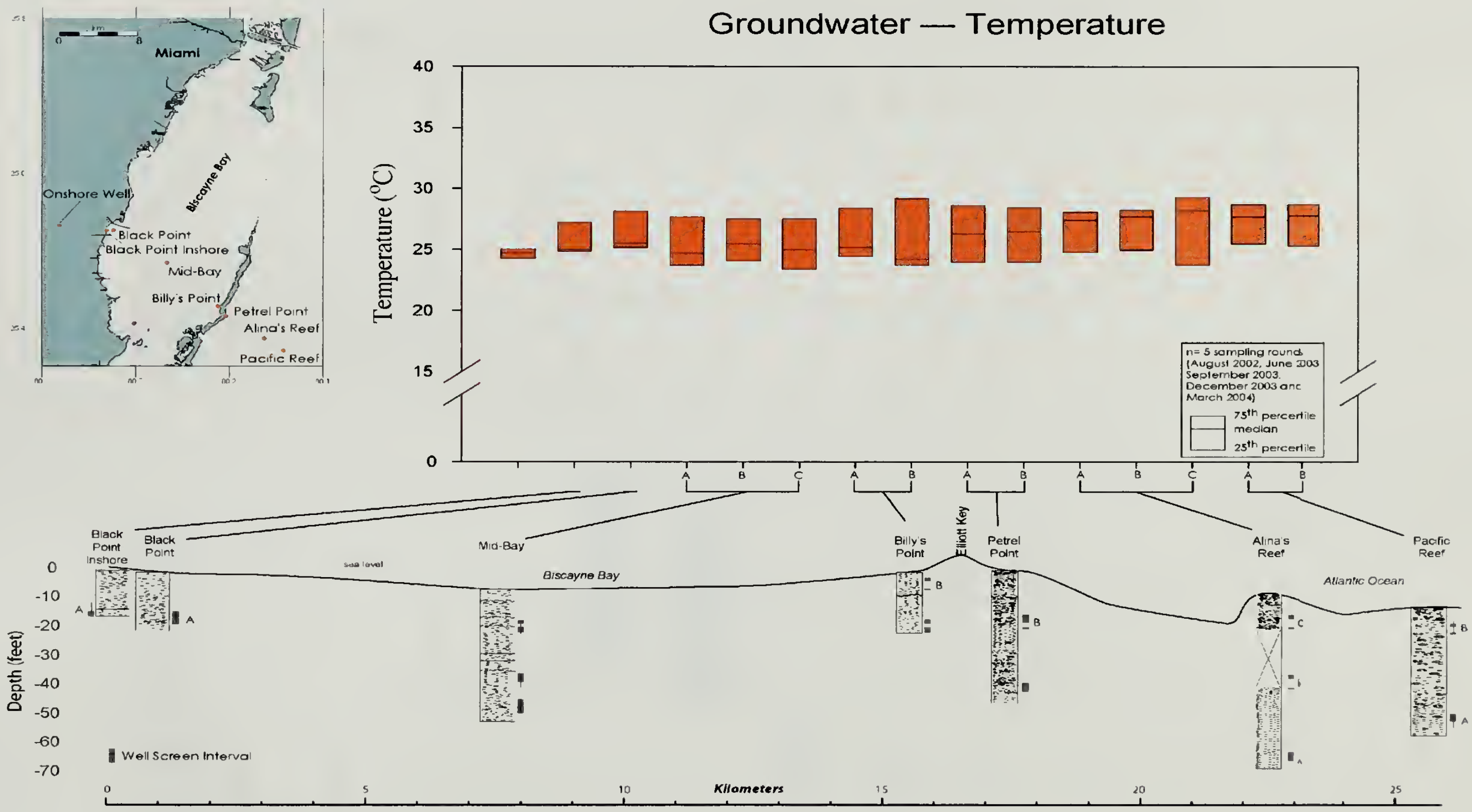

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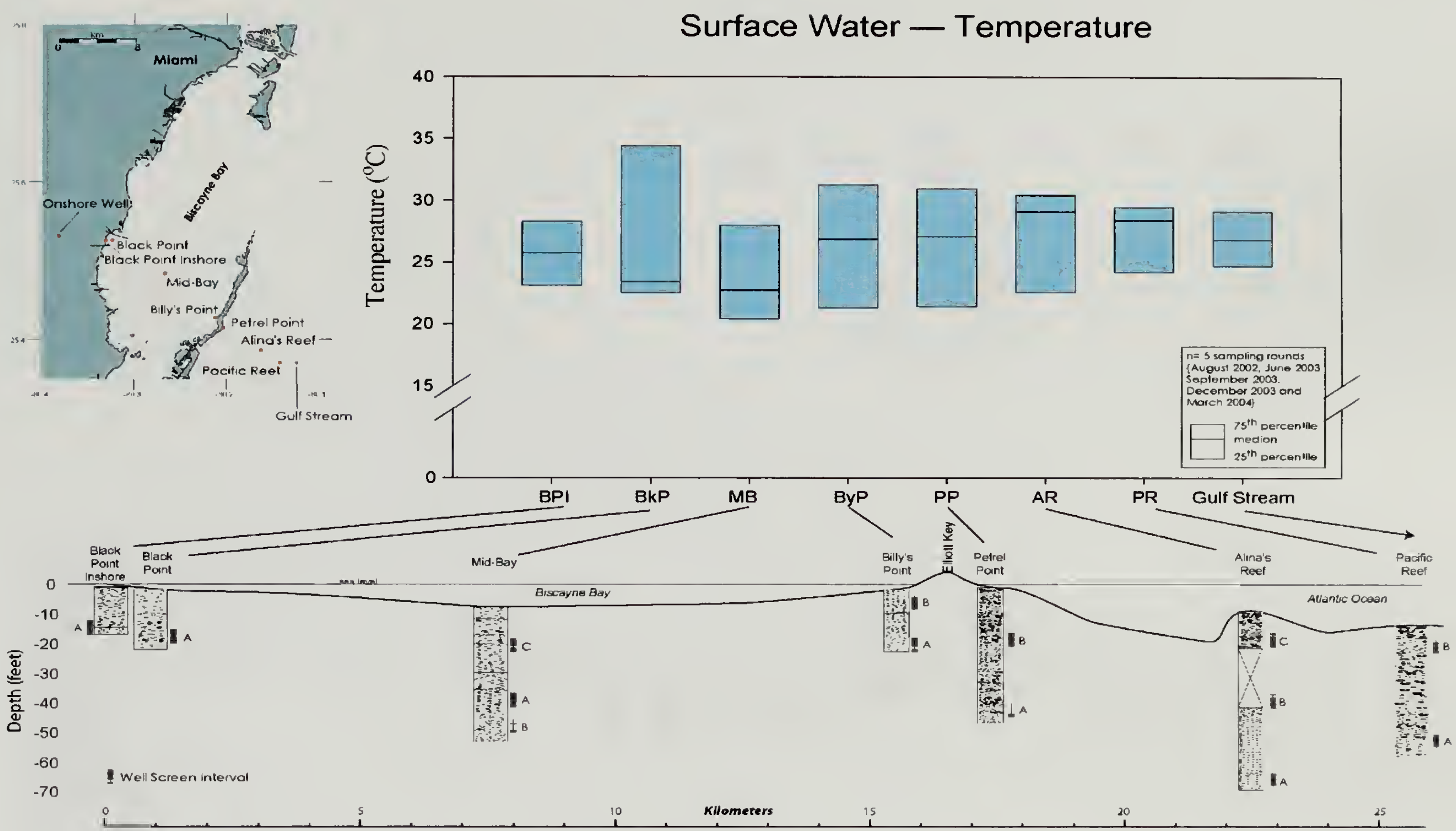

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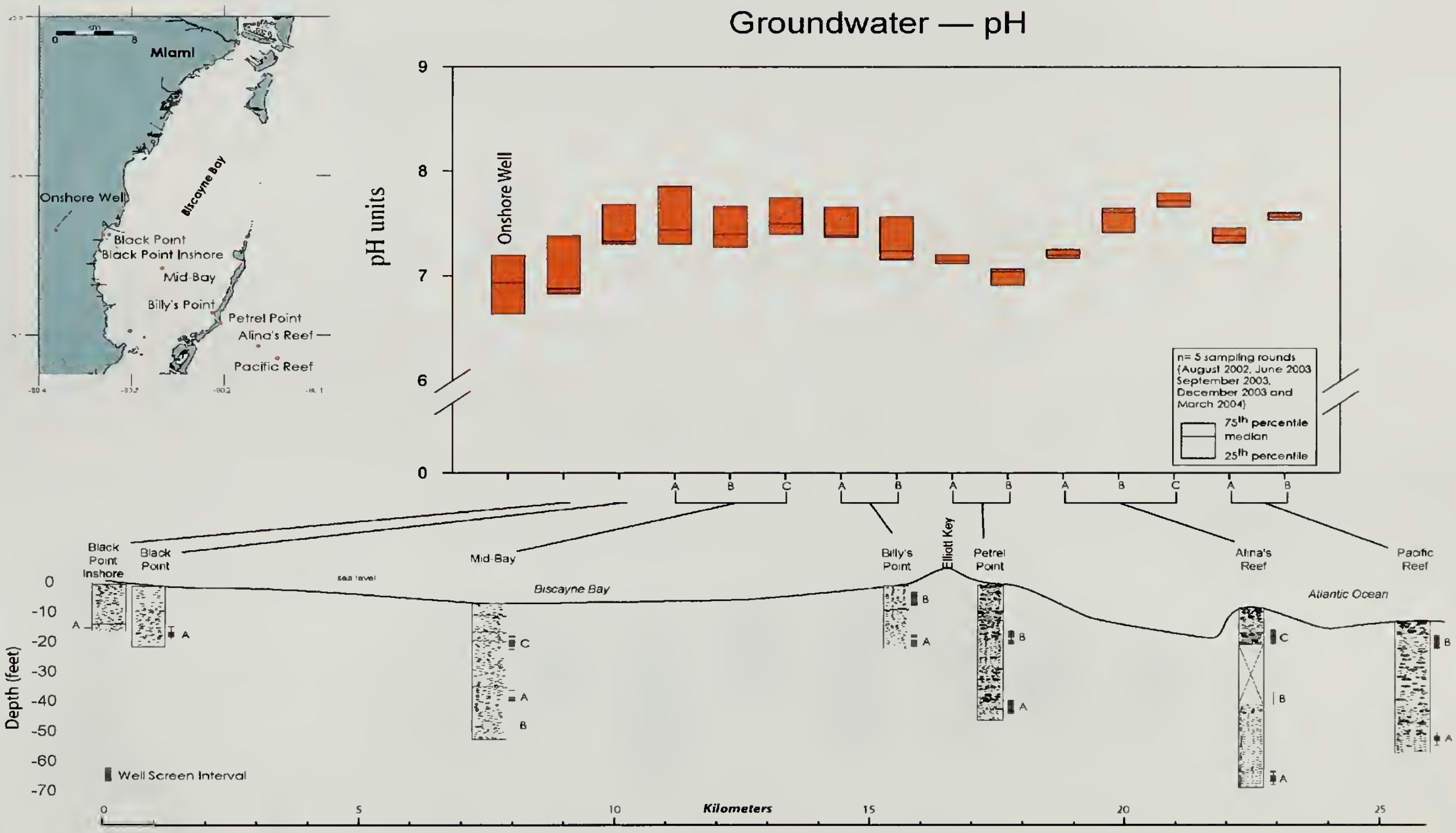

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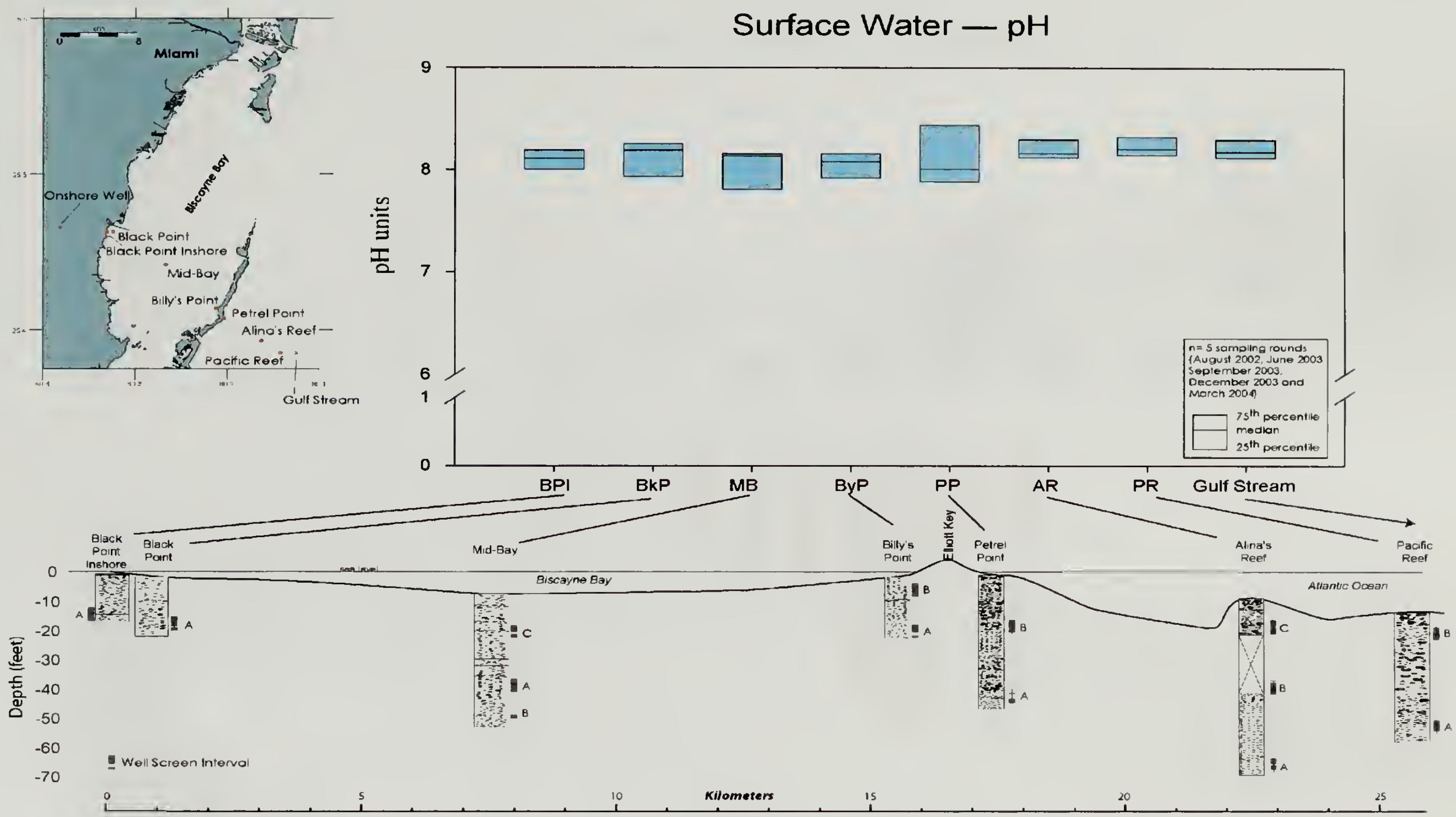

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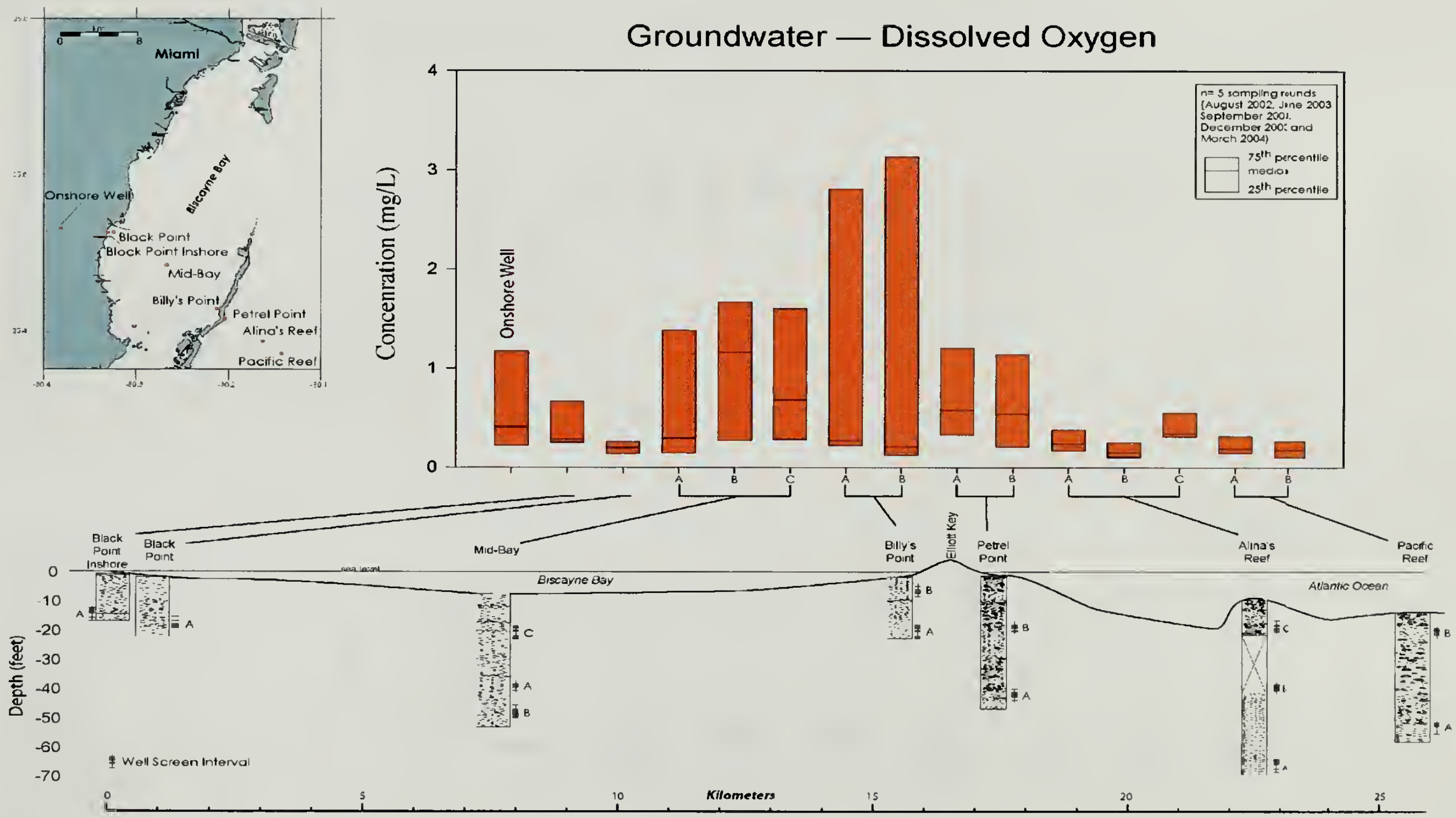

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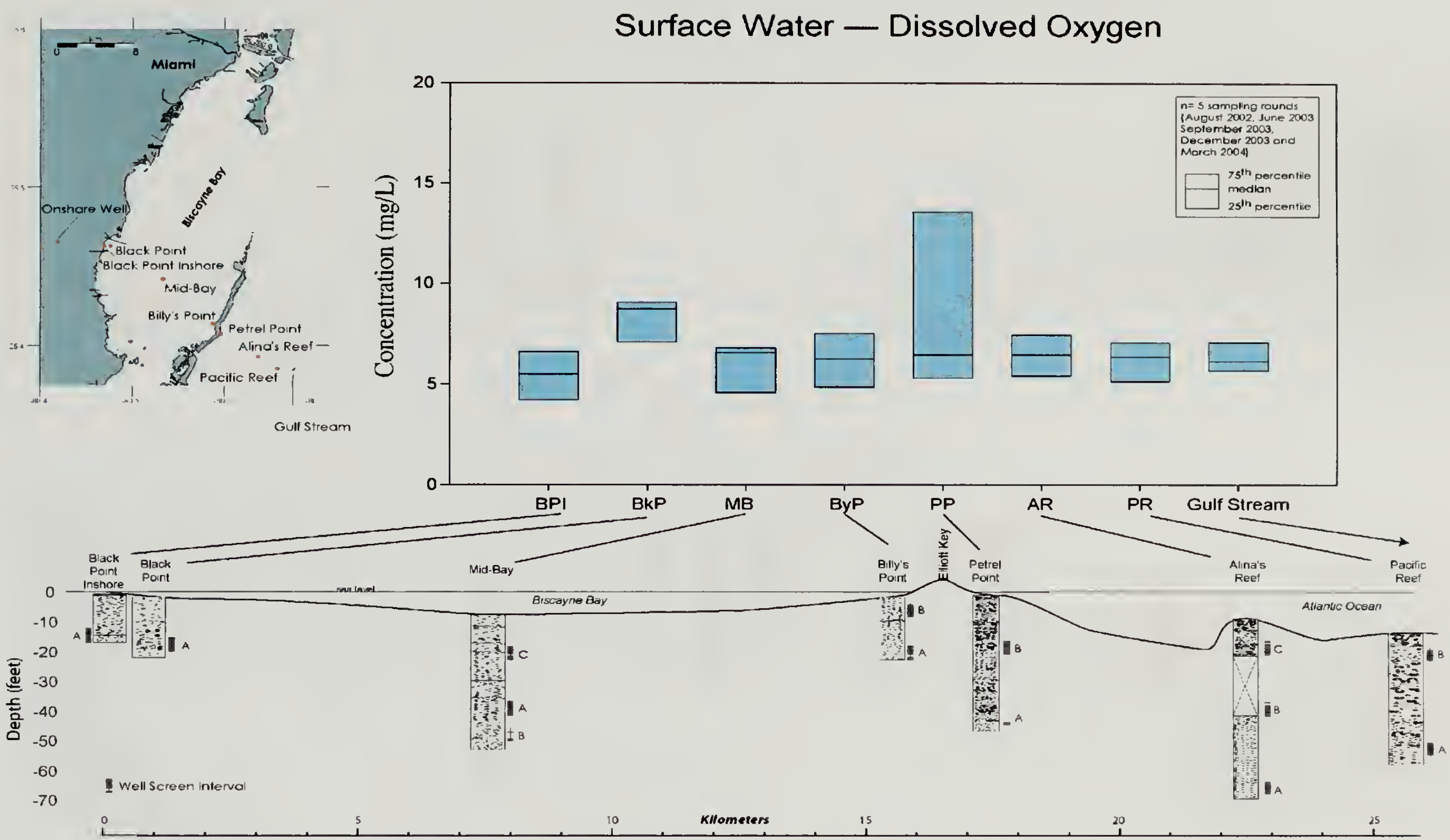

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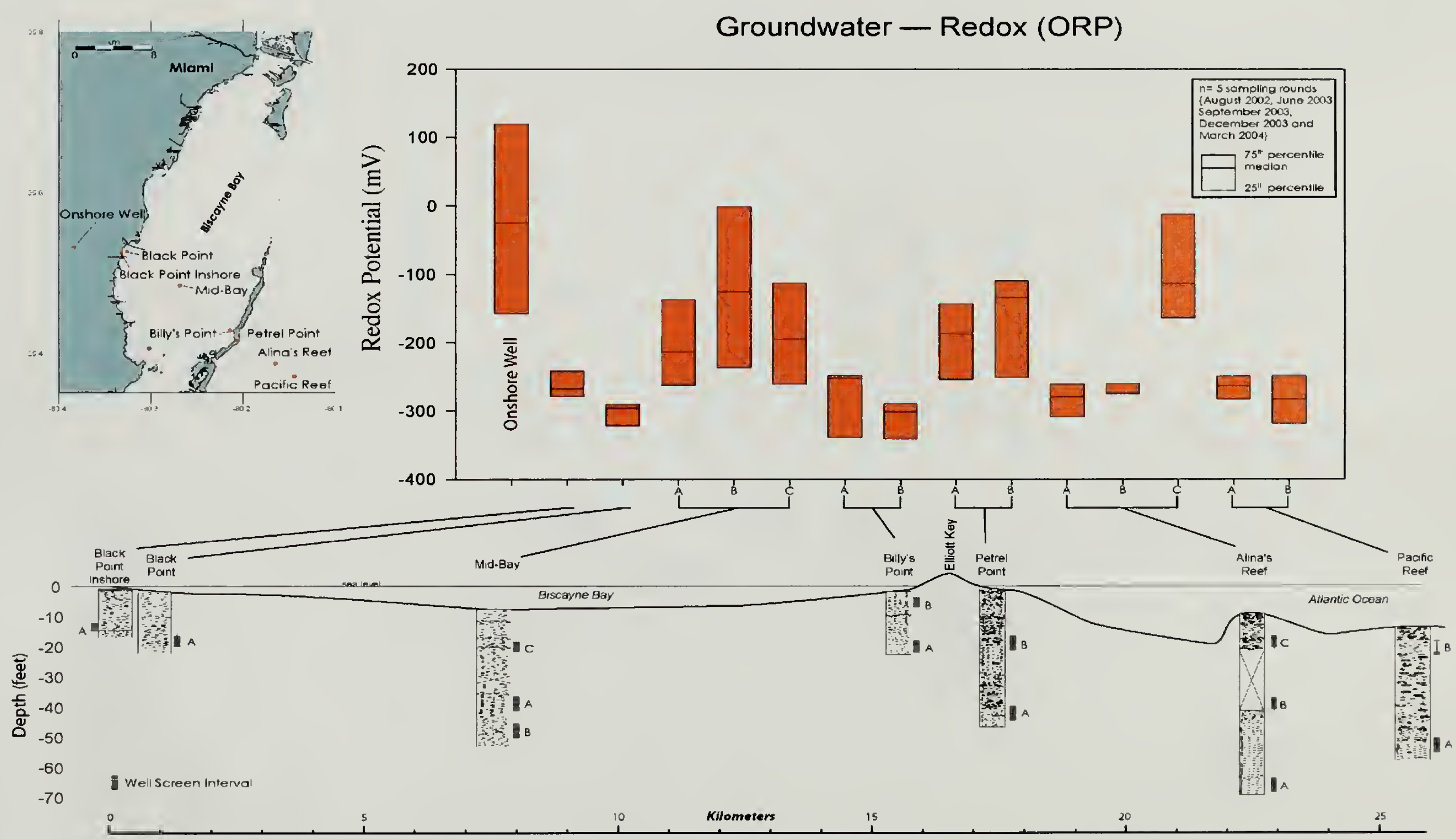

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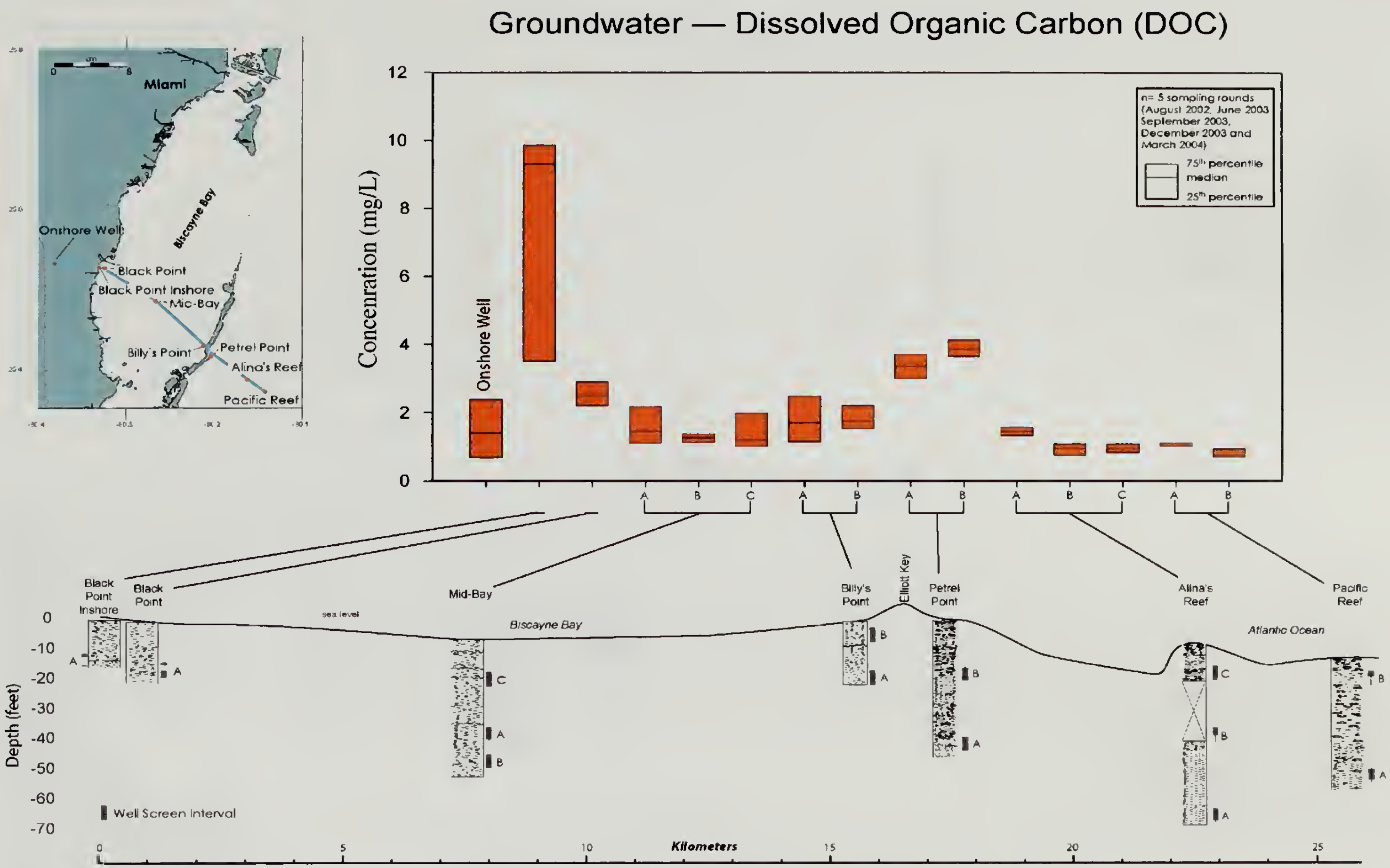
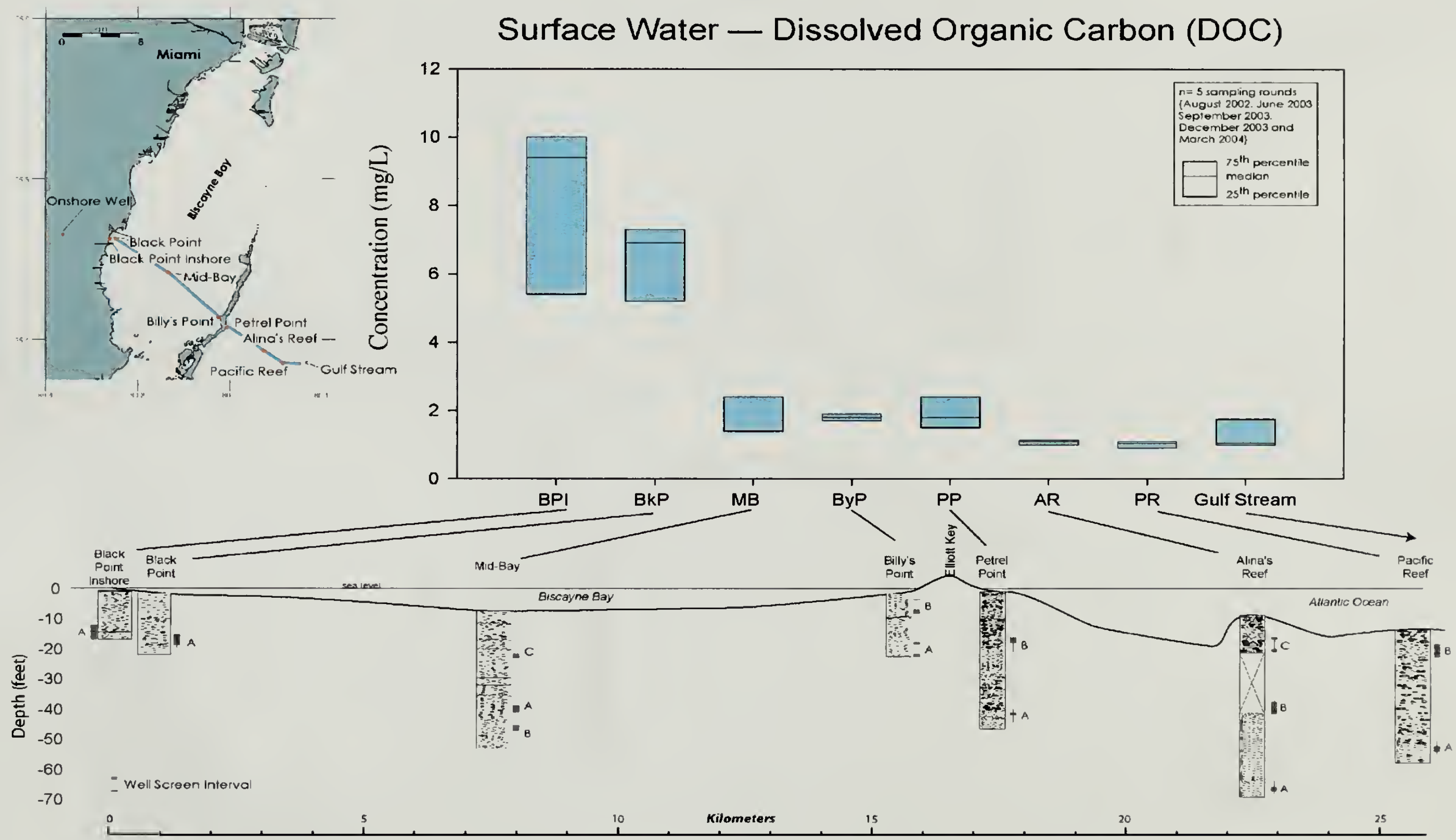


Appendix B2. Ground- and surface-water nutrient species within BNP



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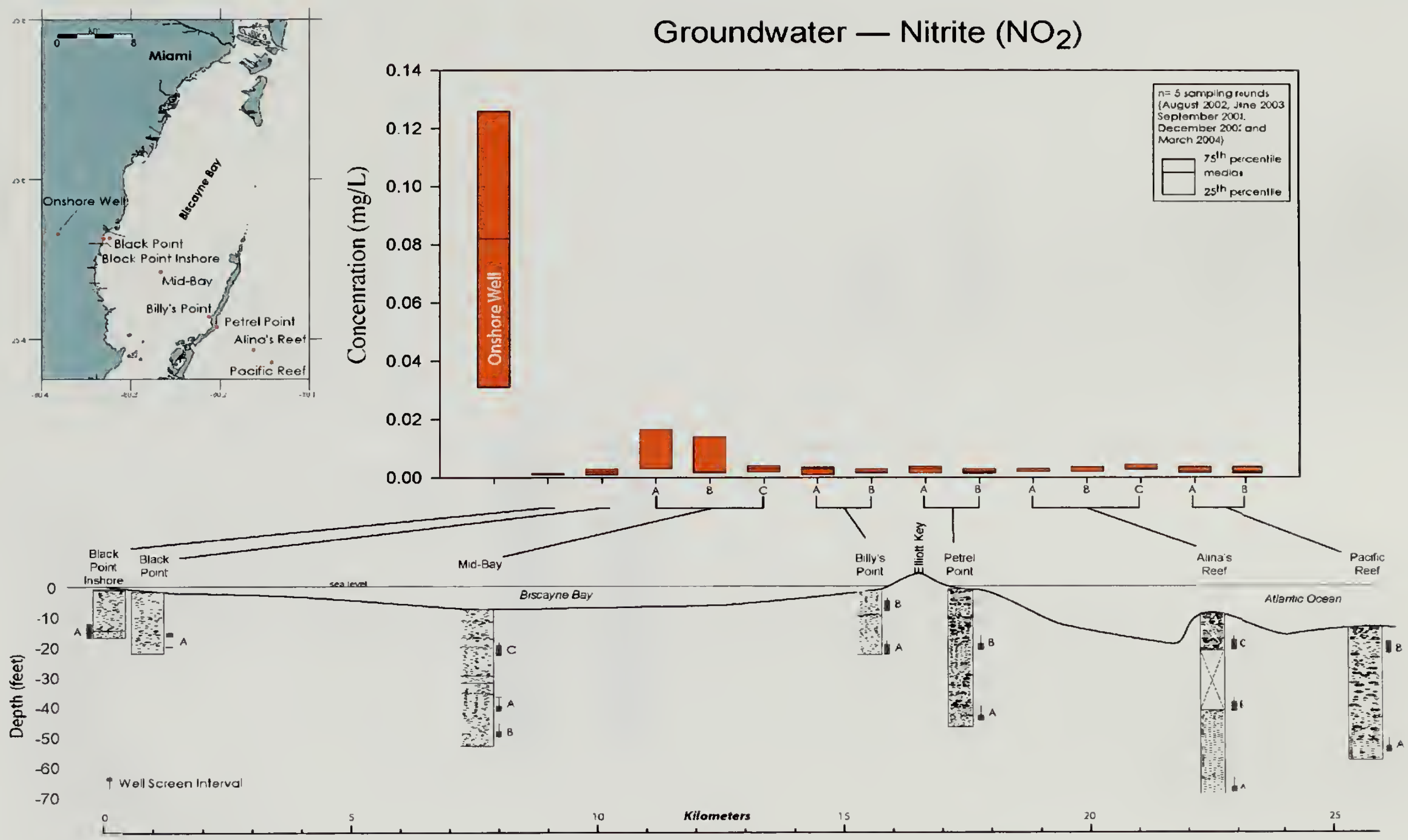

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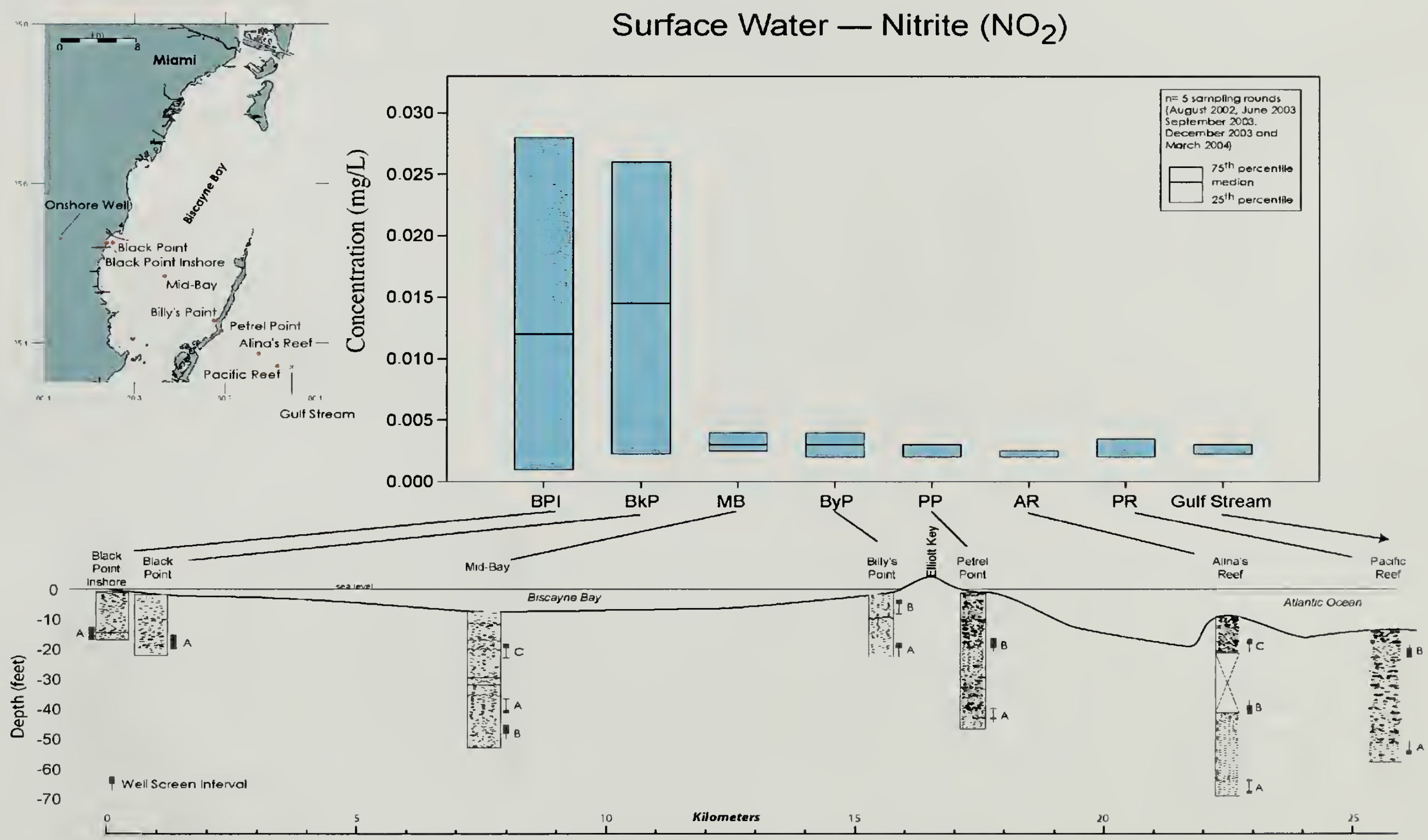

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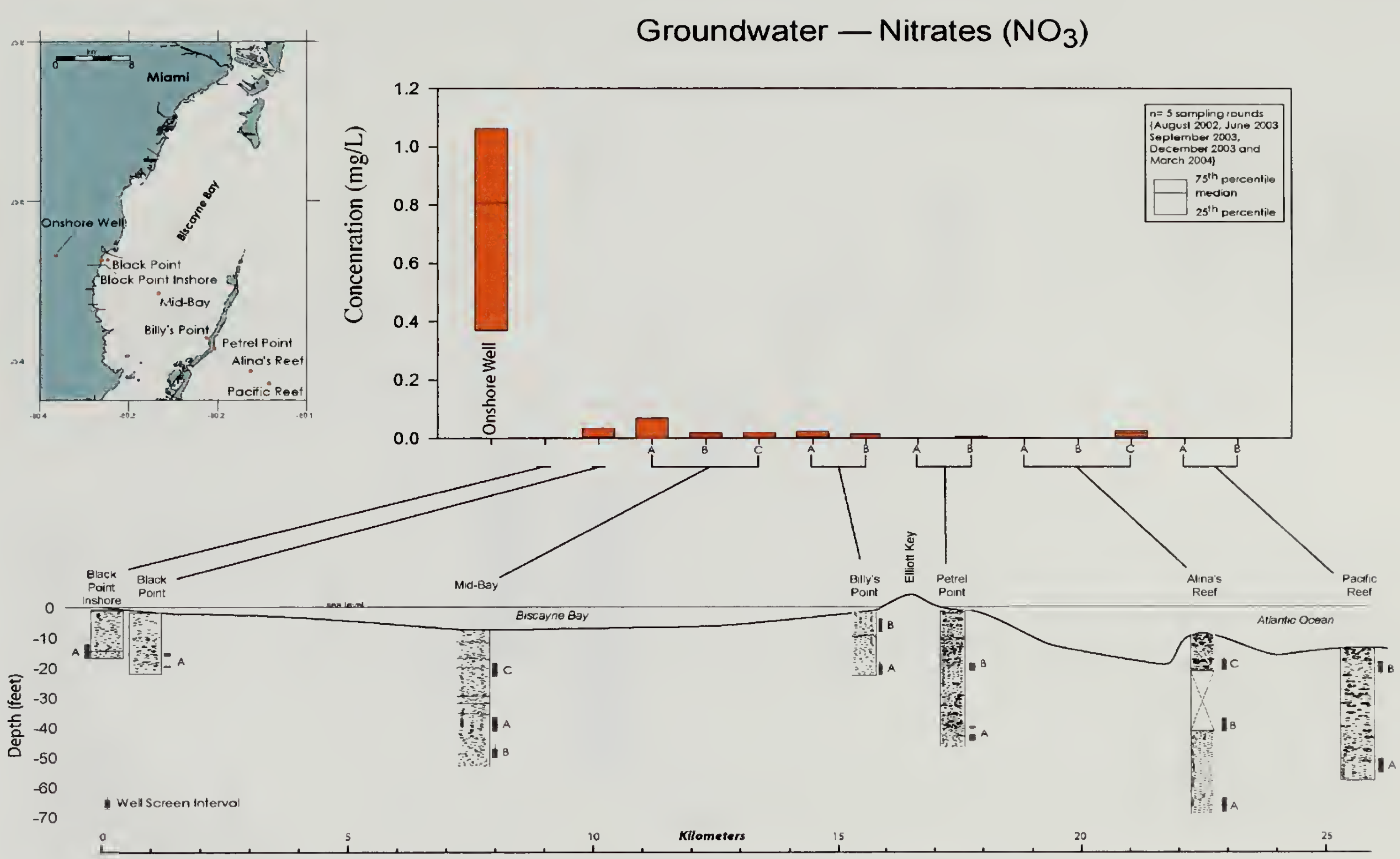

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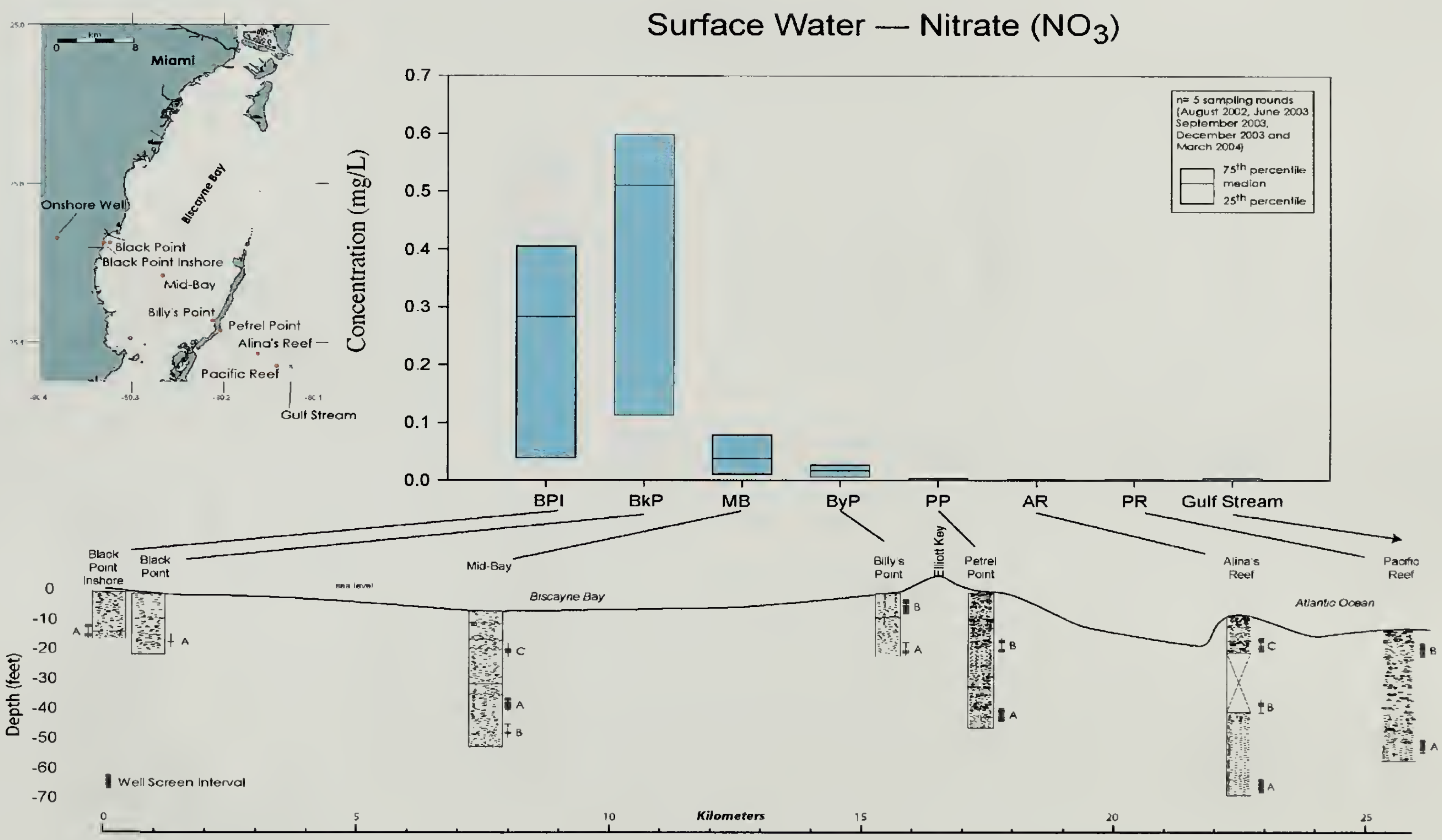

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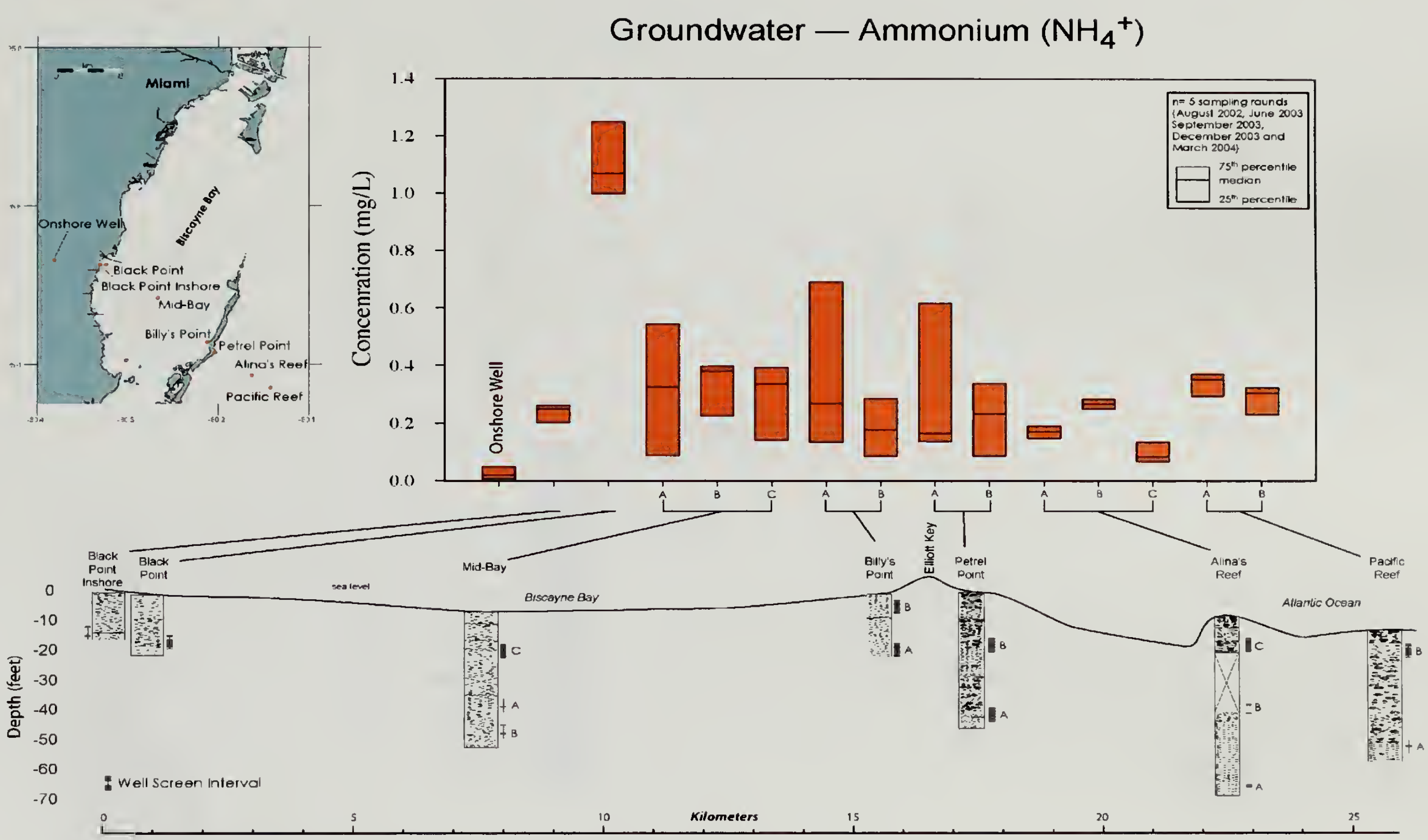

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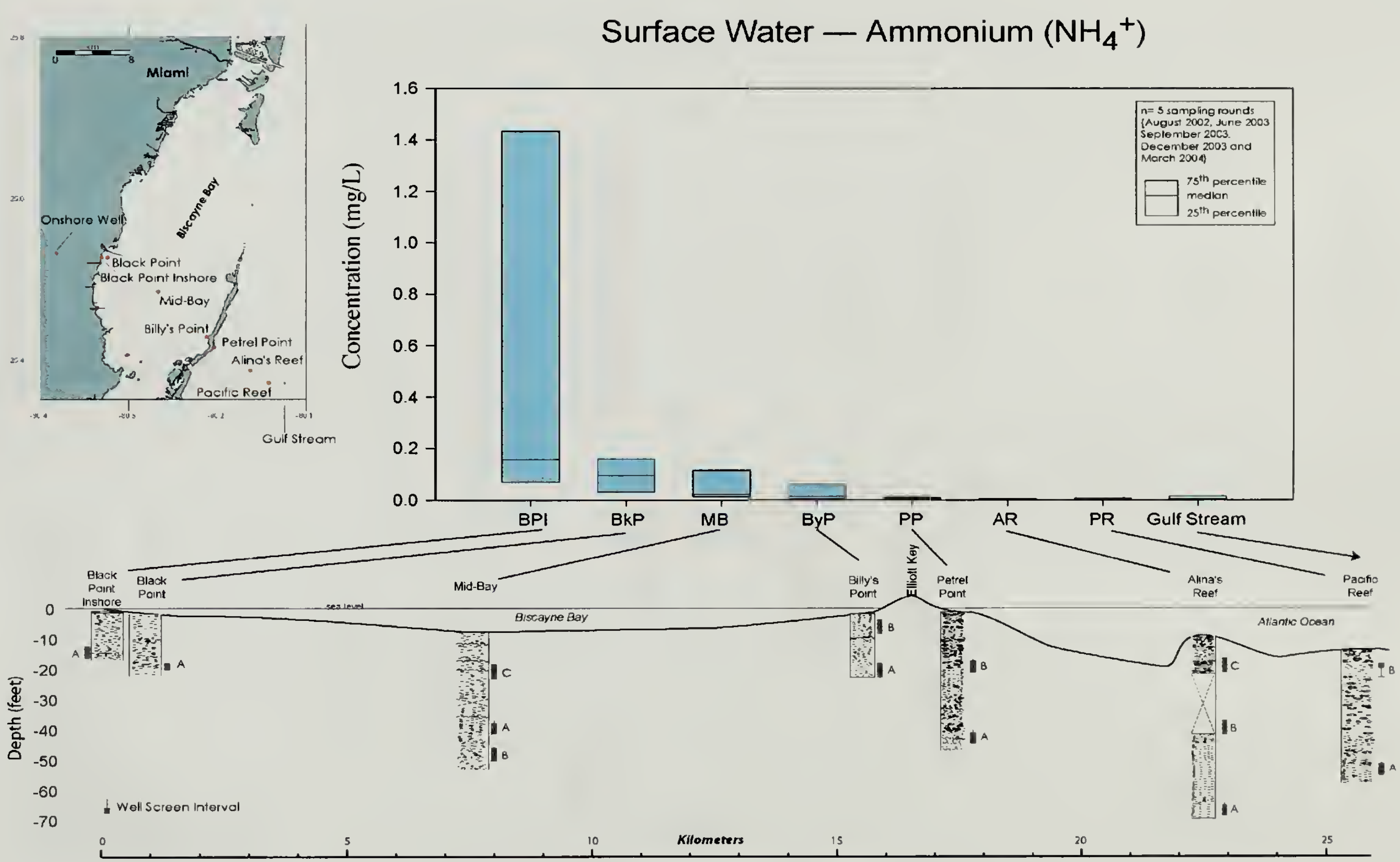

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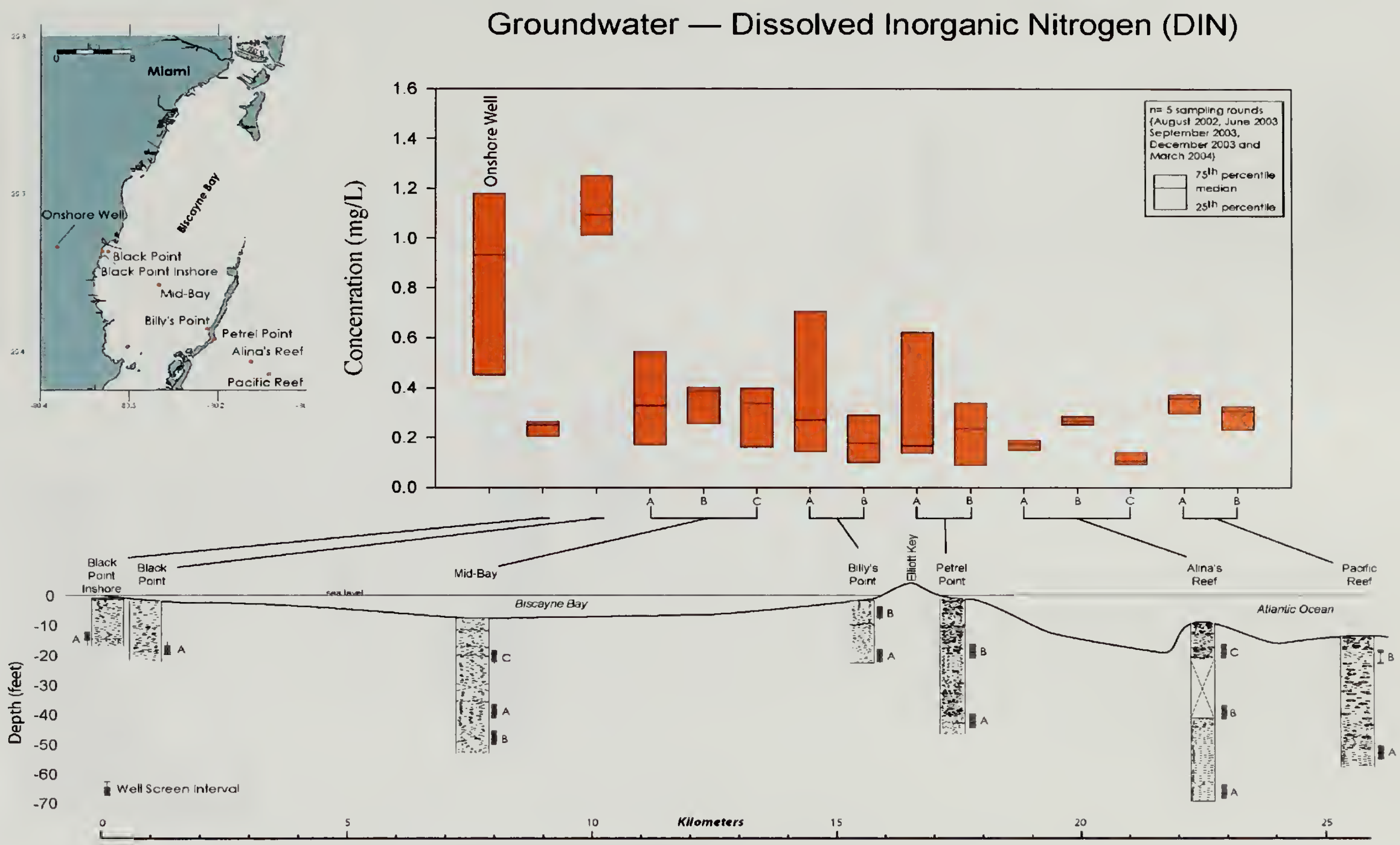

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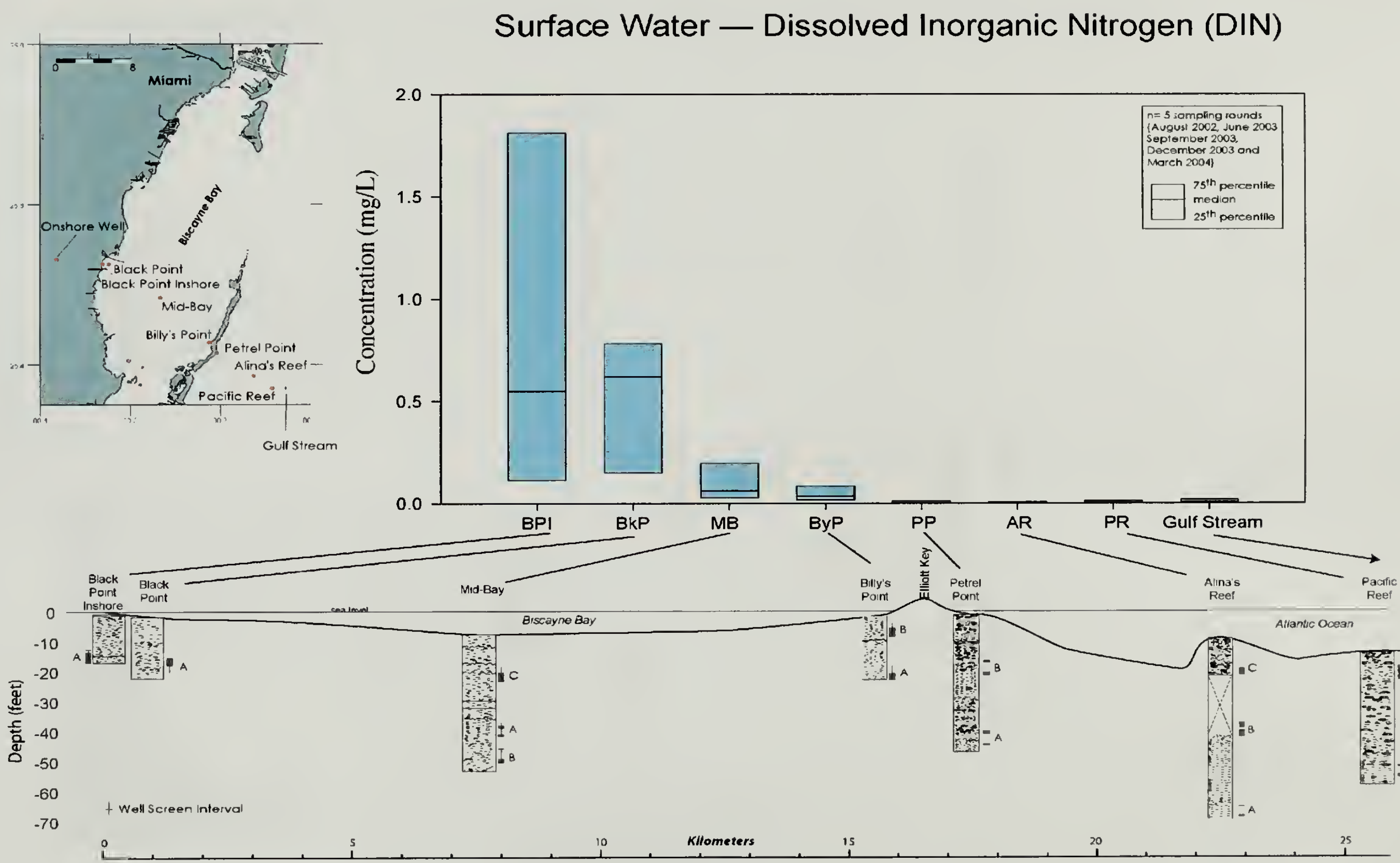

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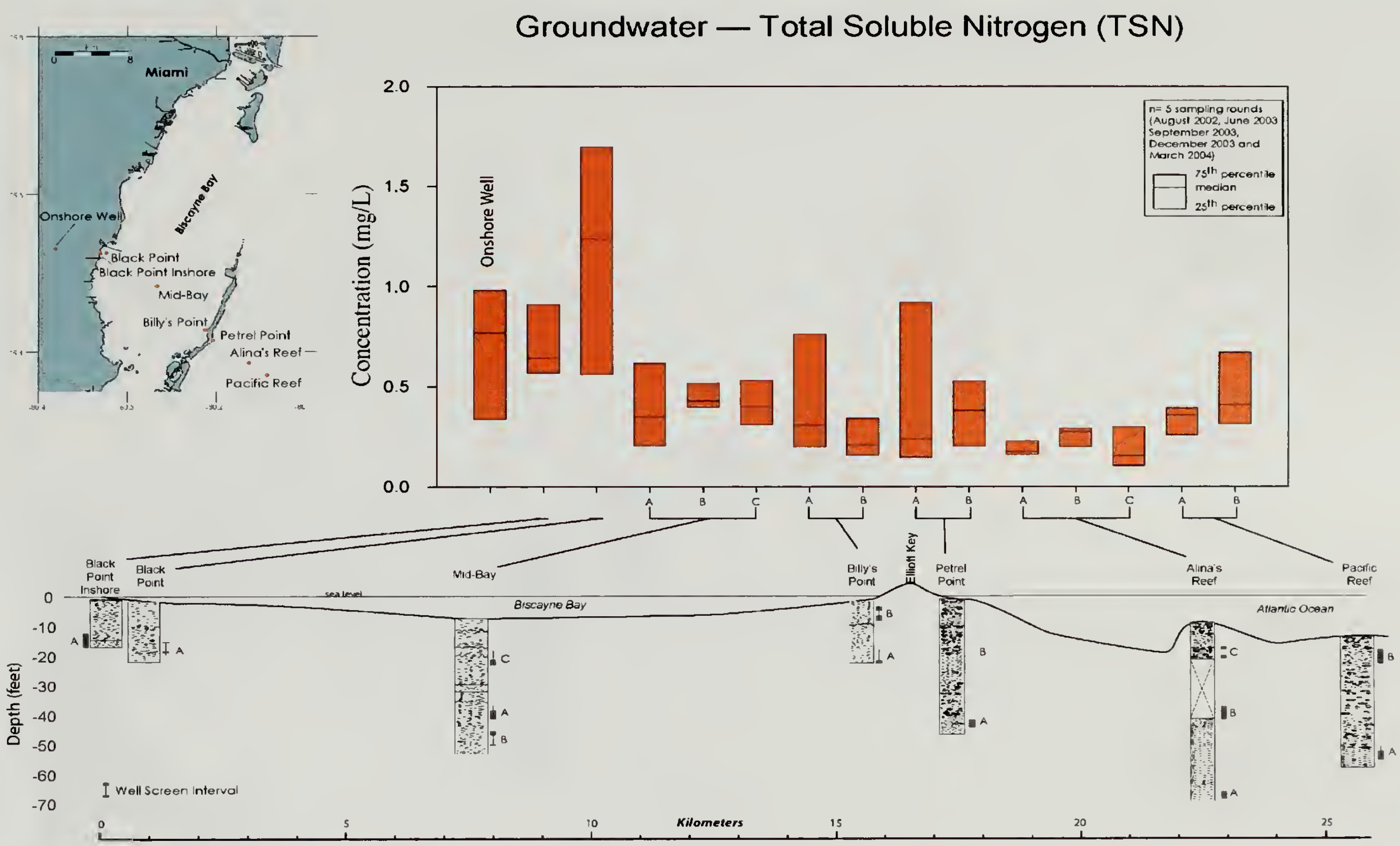

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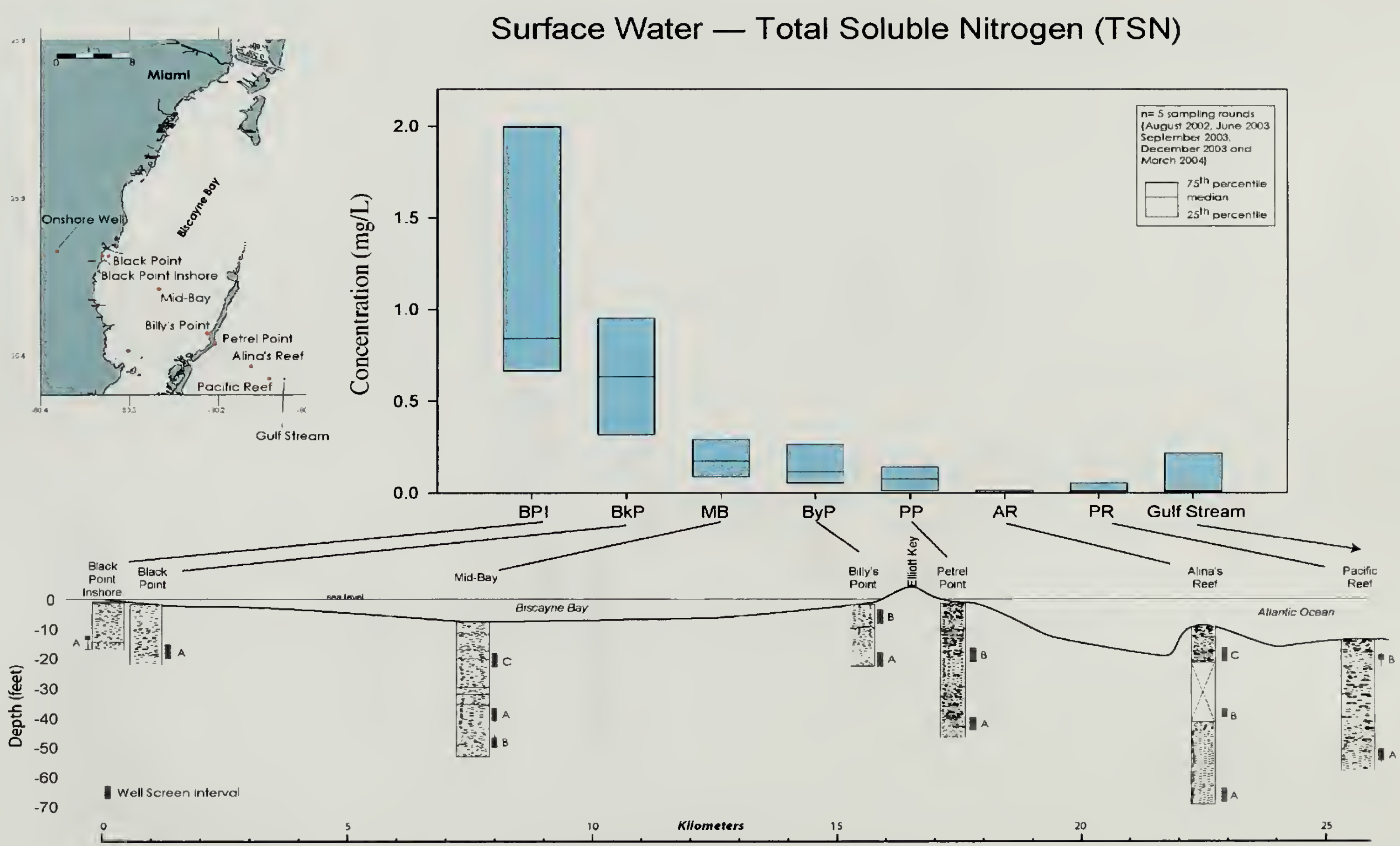

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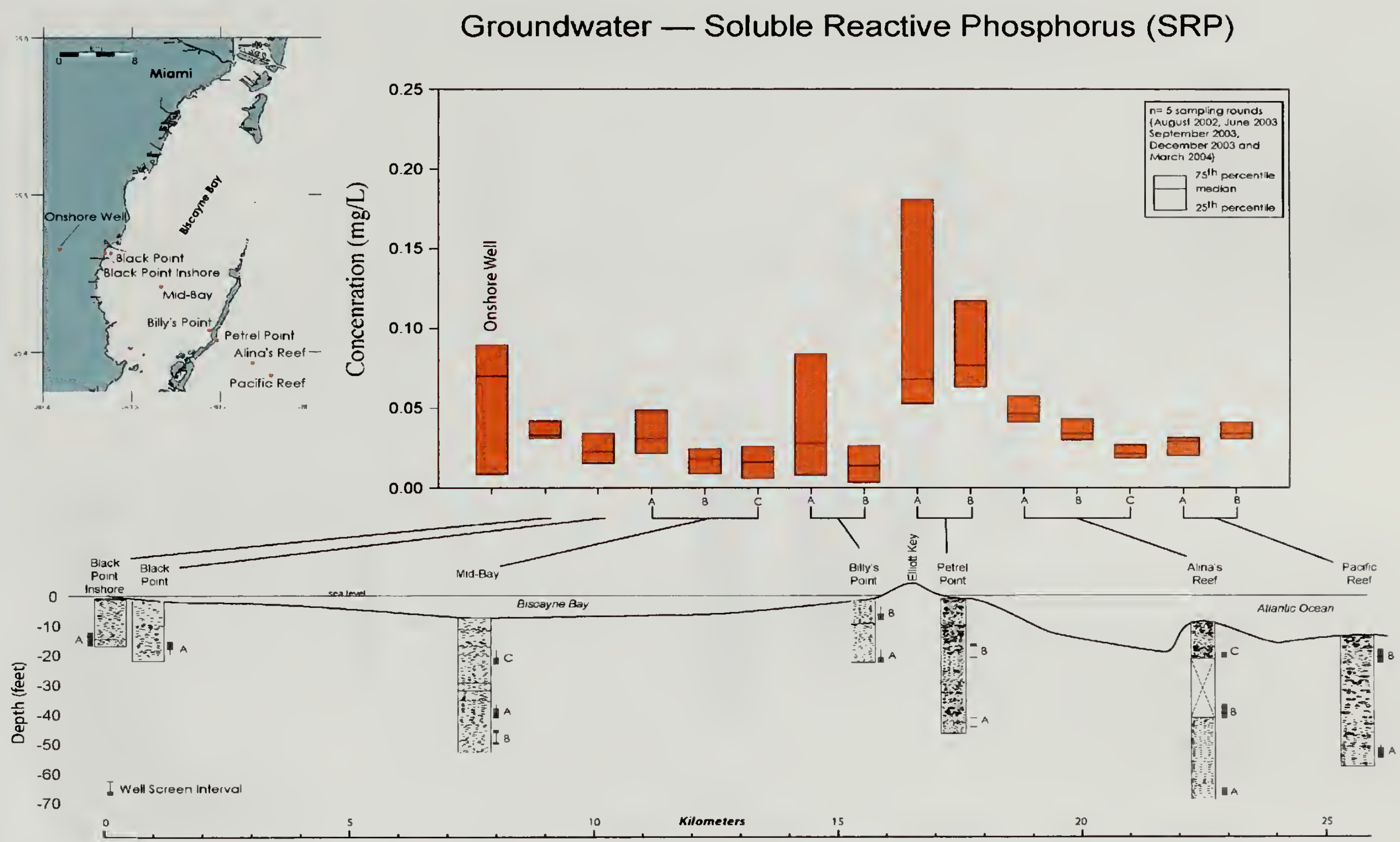

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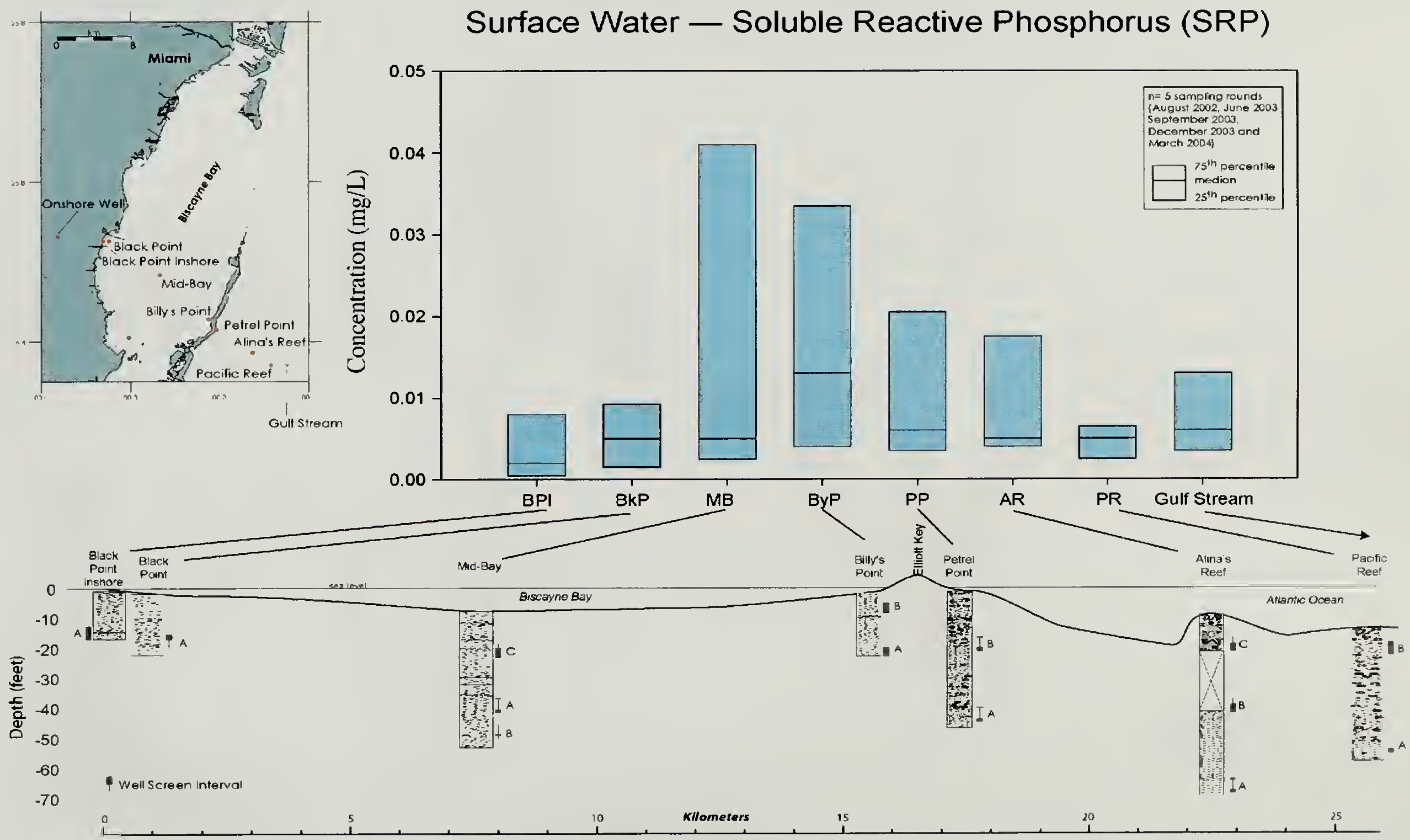

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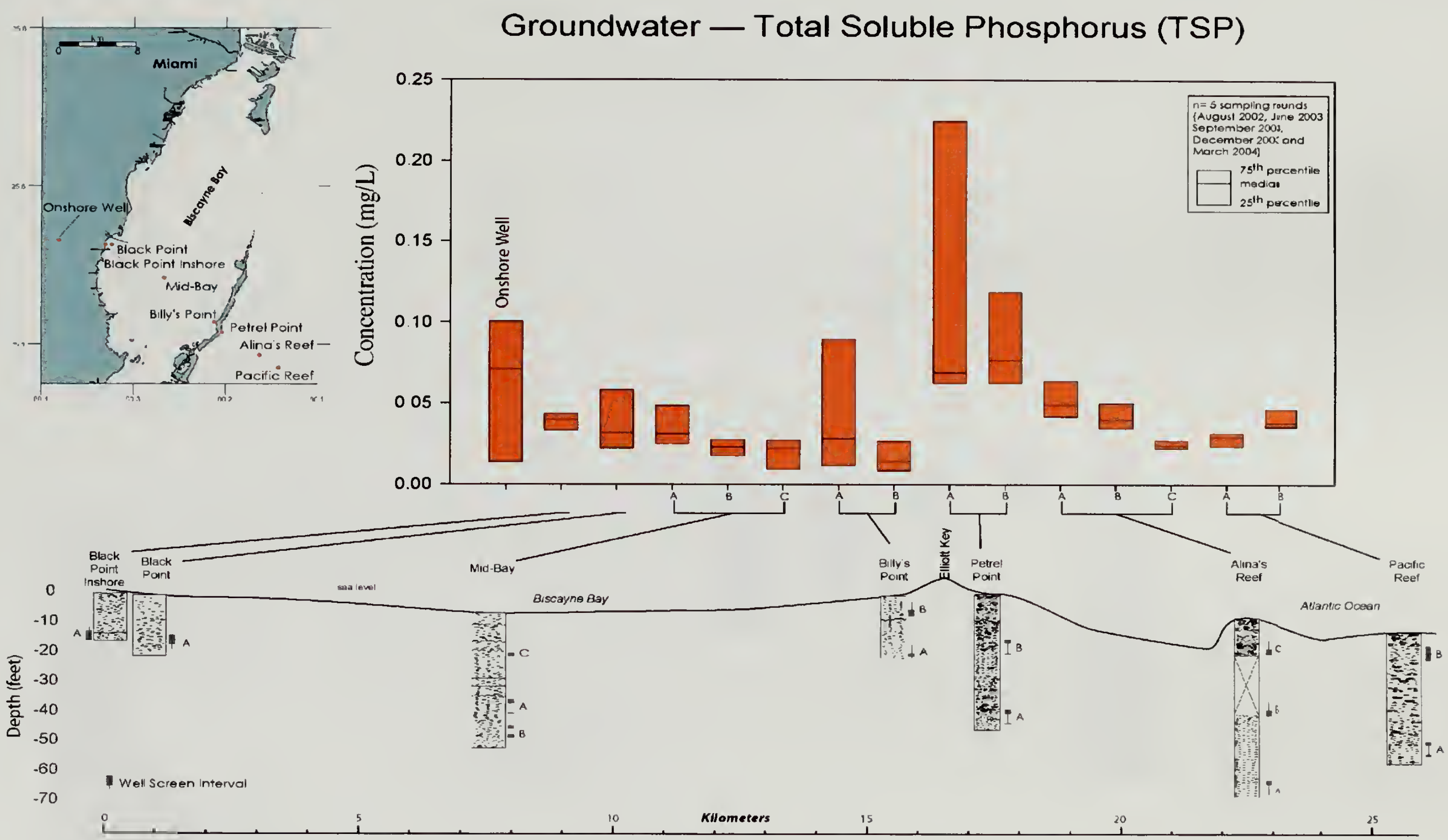

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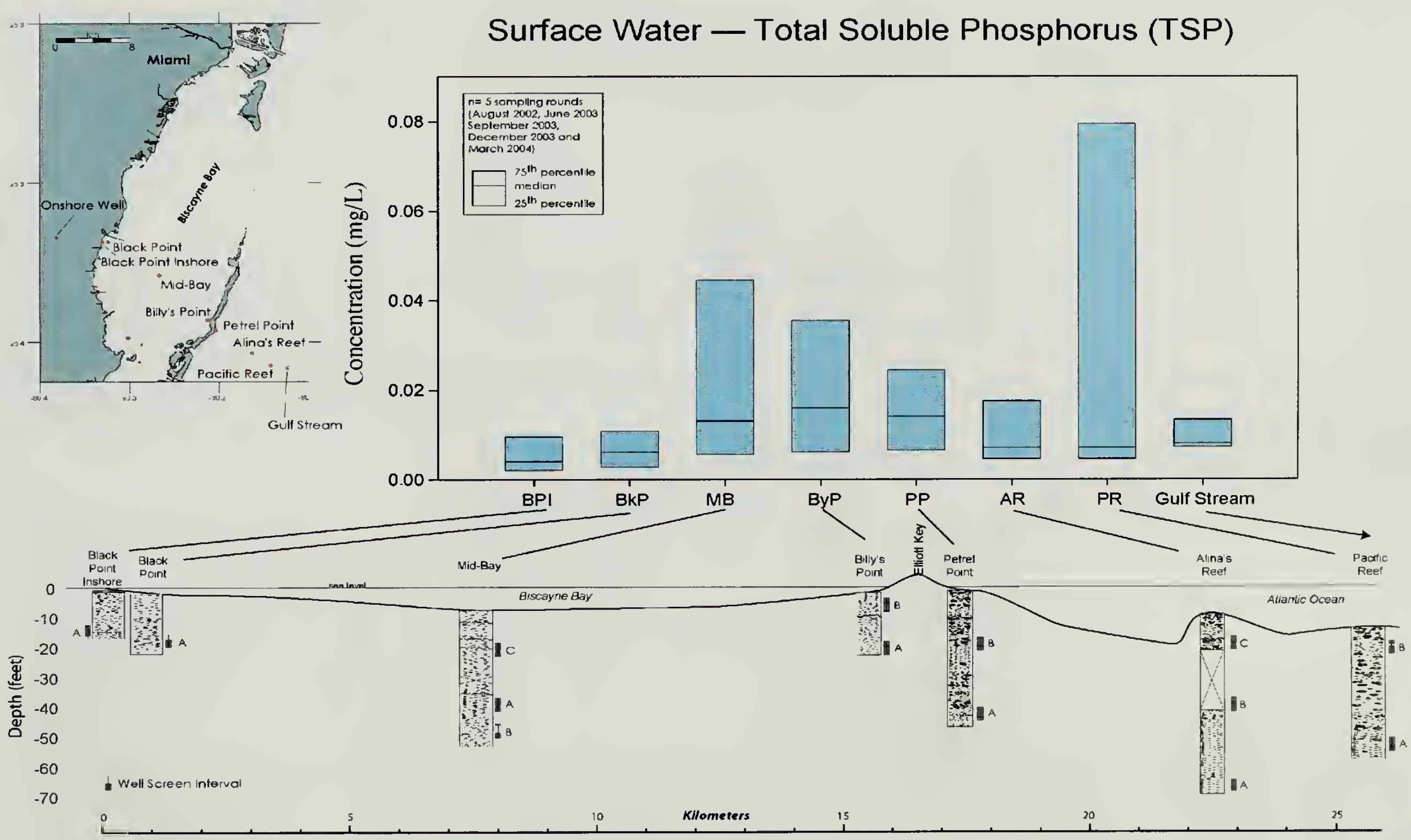

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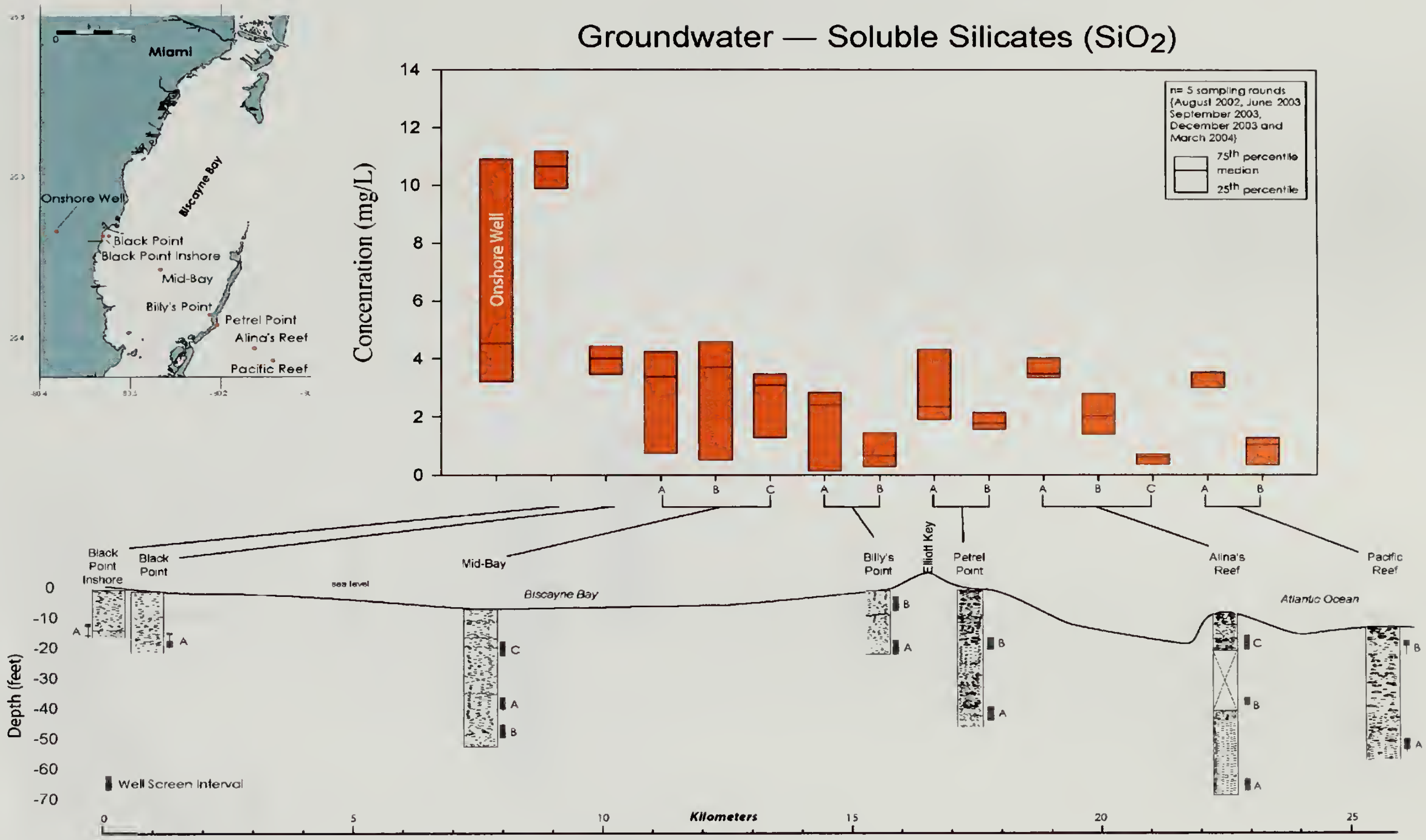

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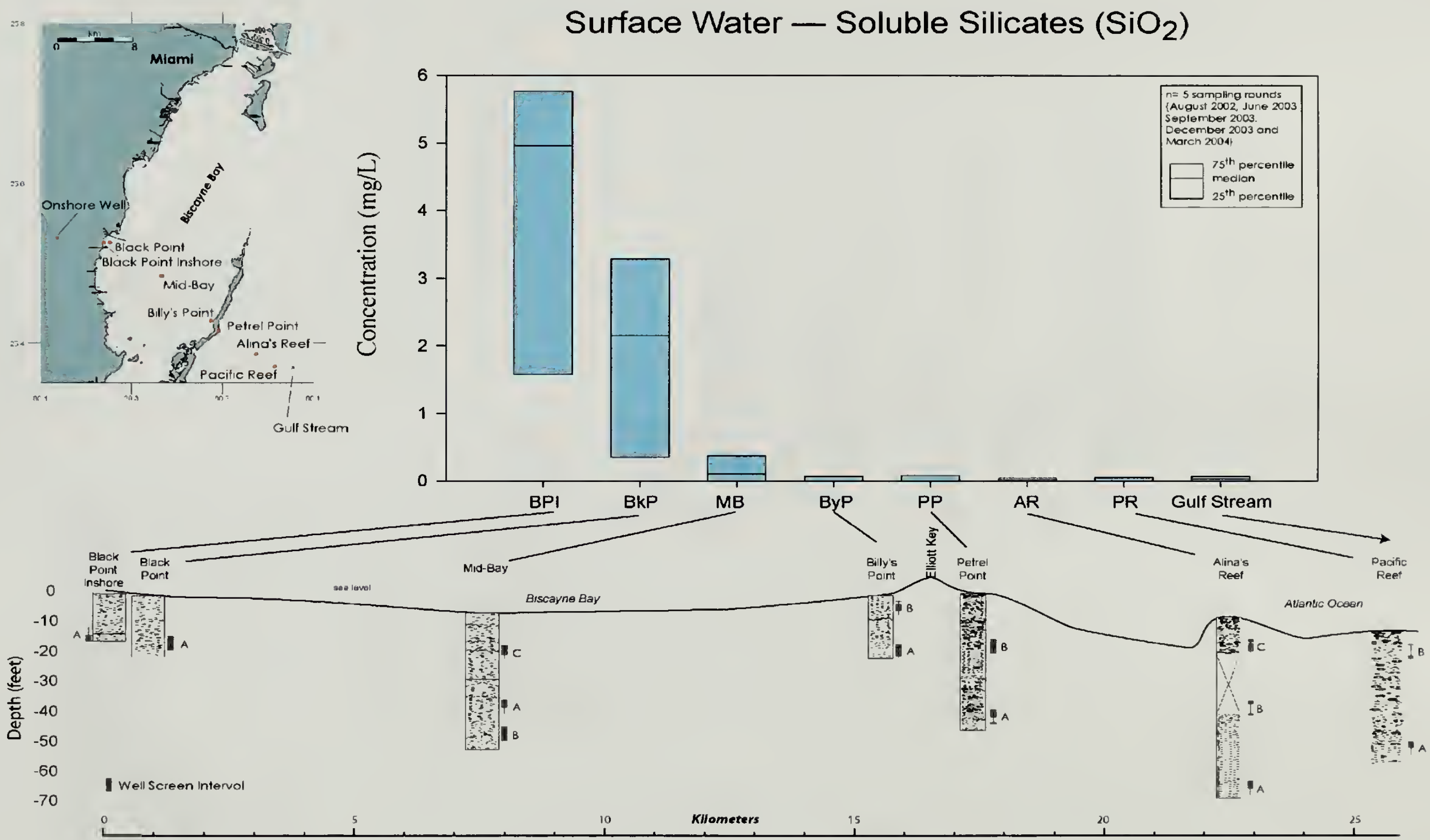

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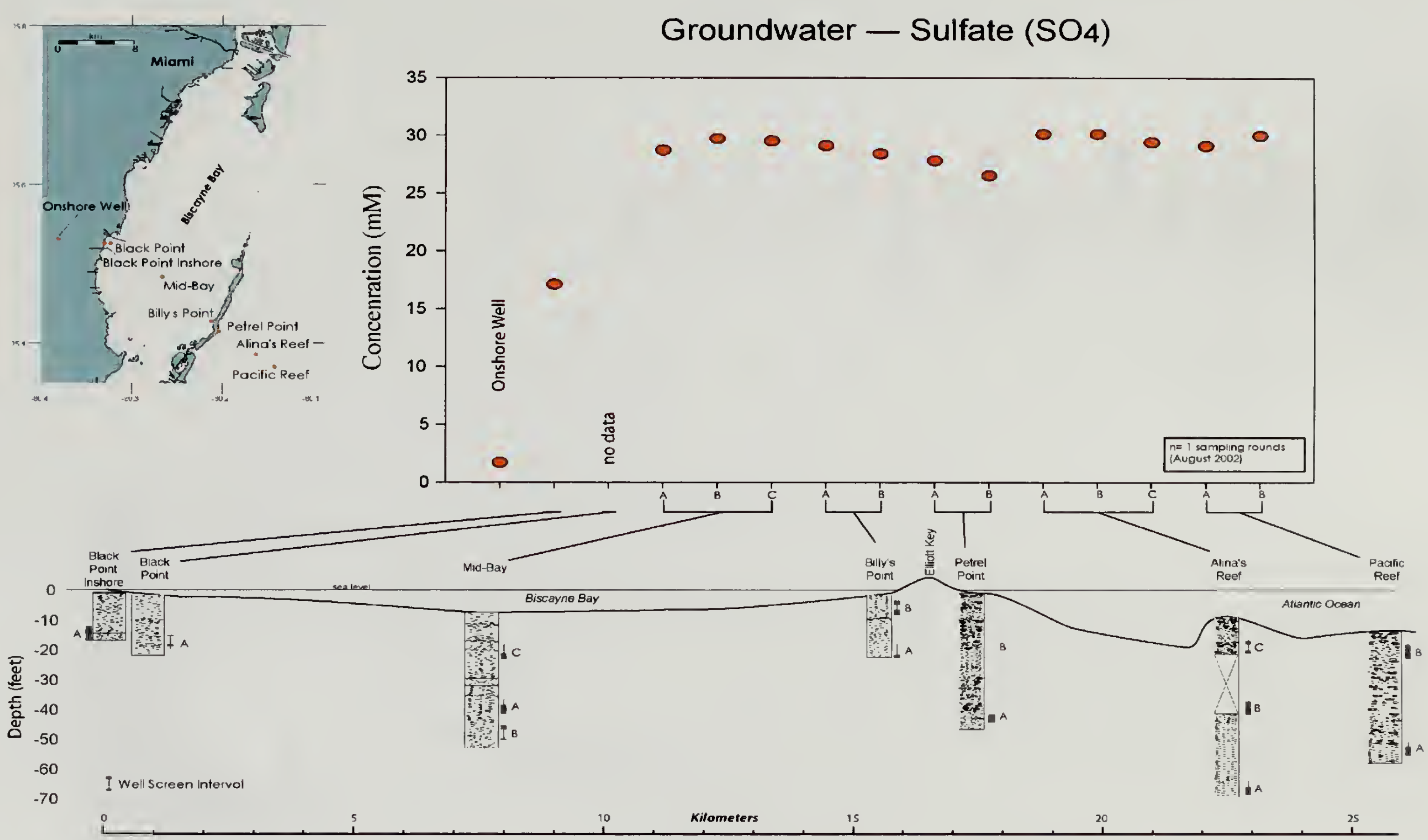

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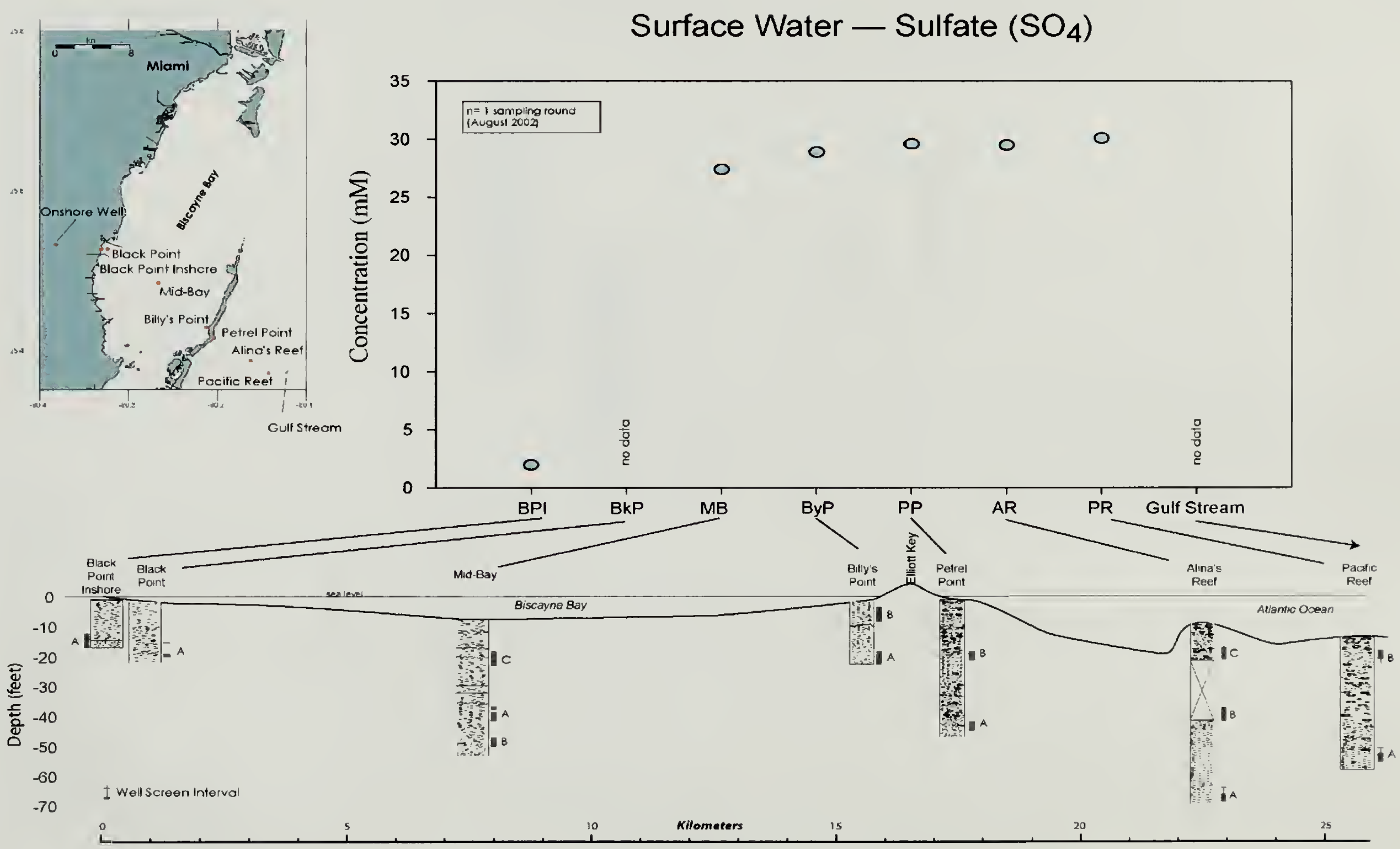

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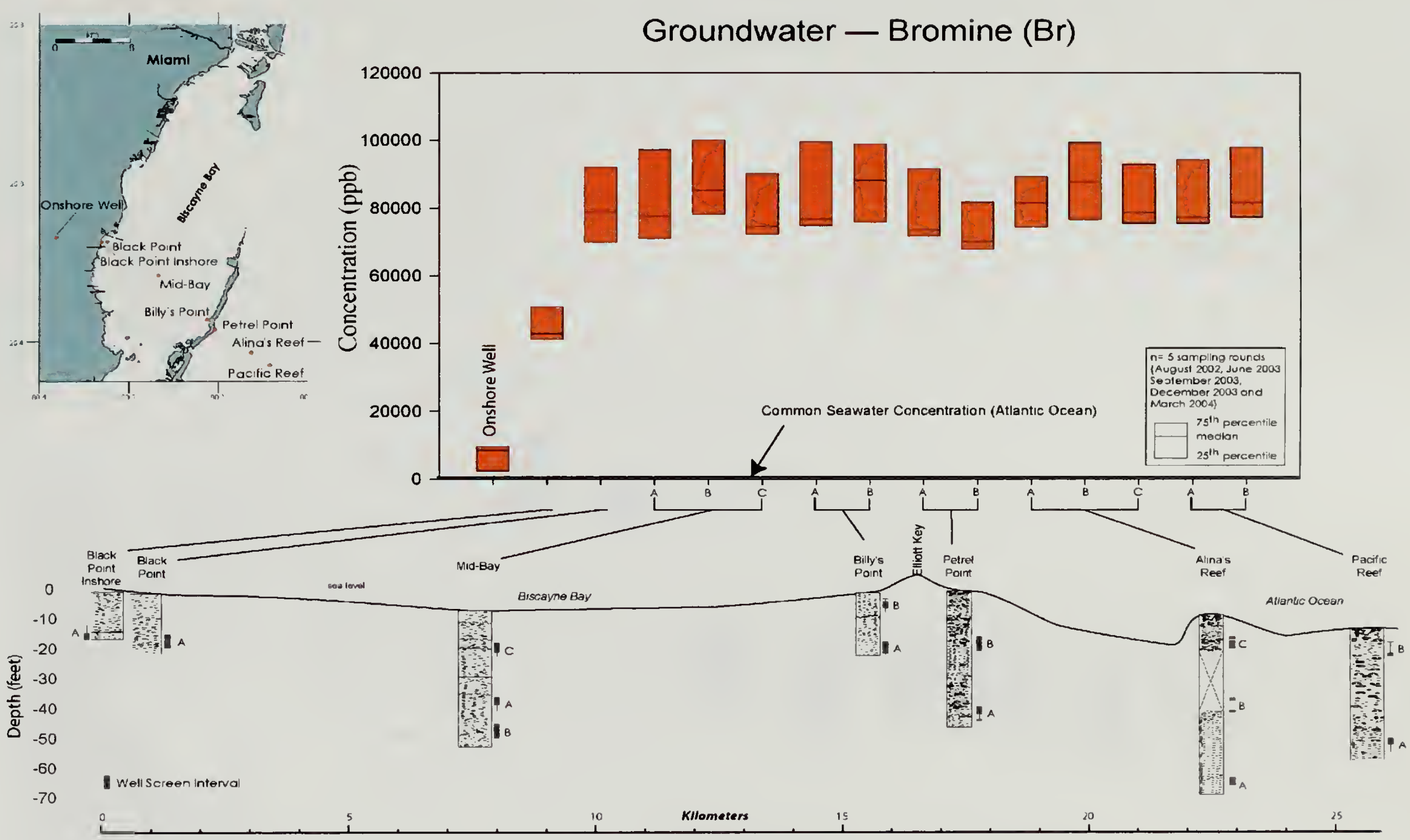
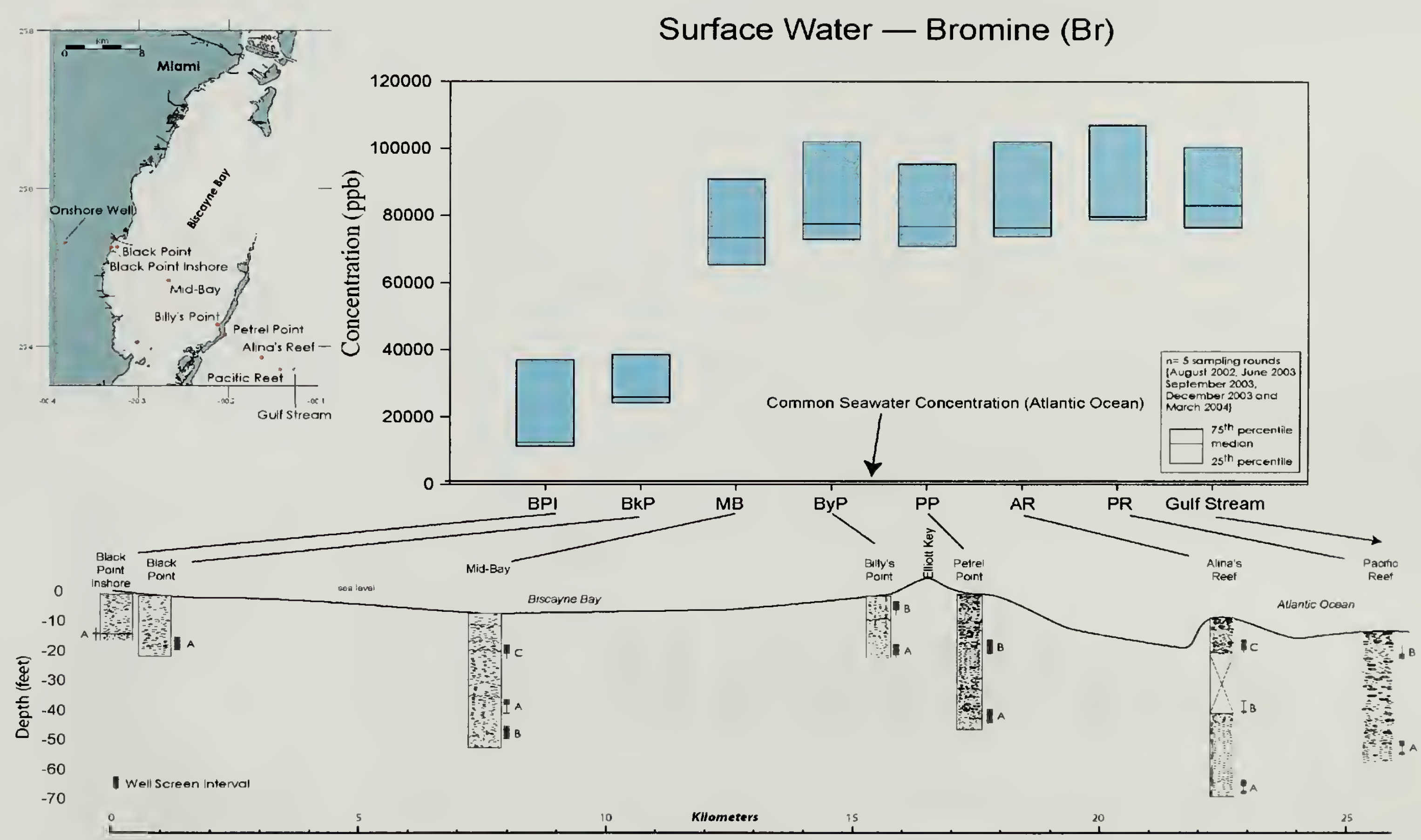


Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



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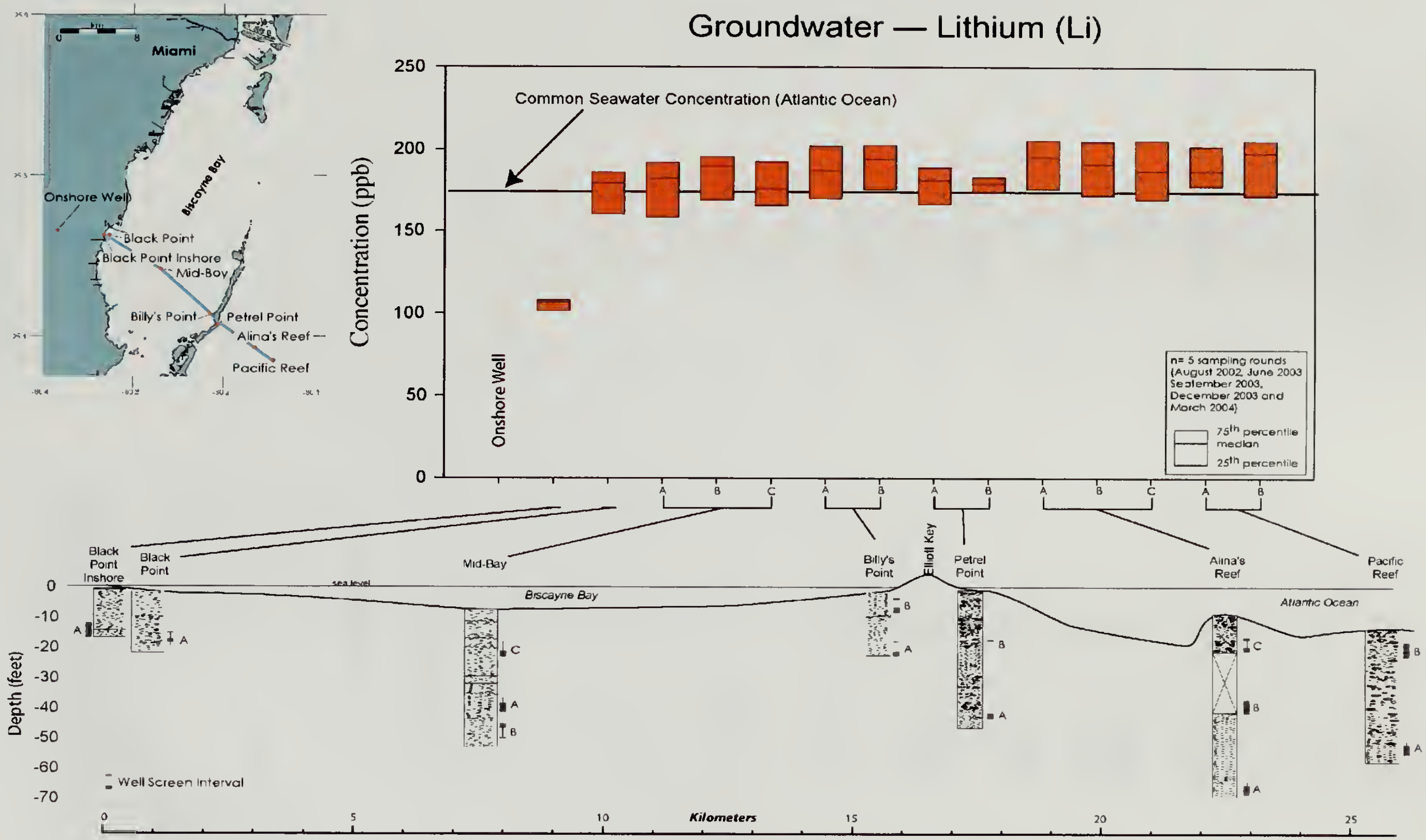

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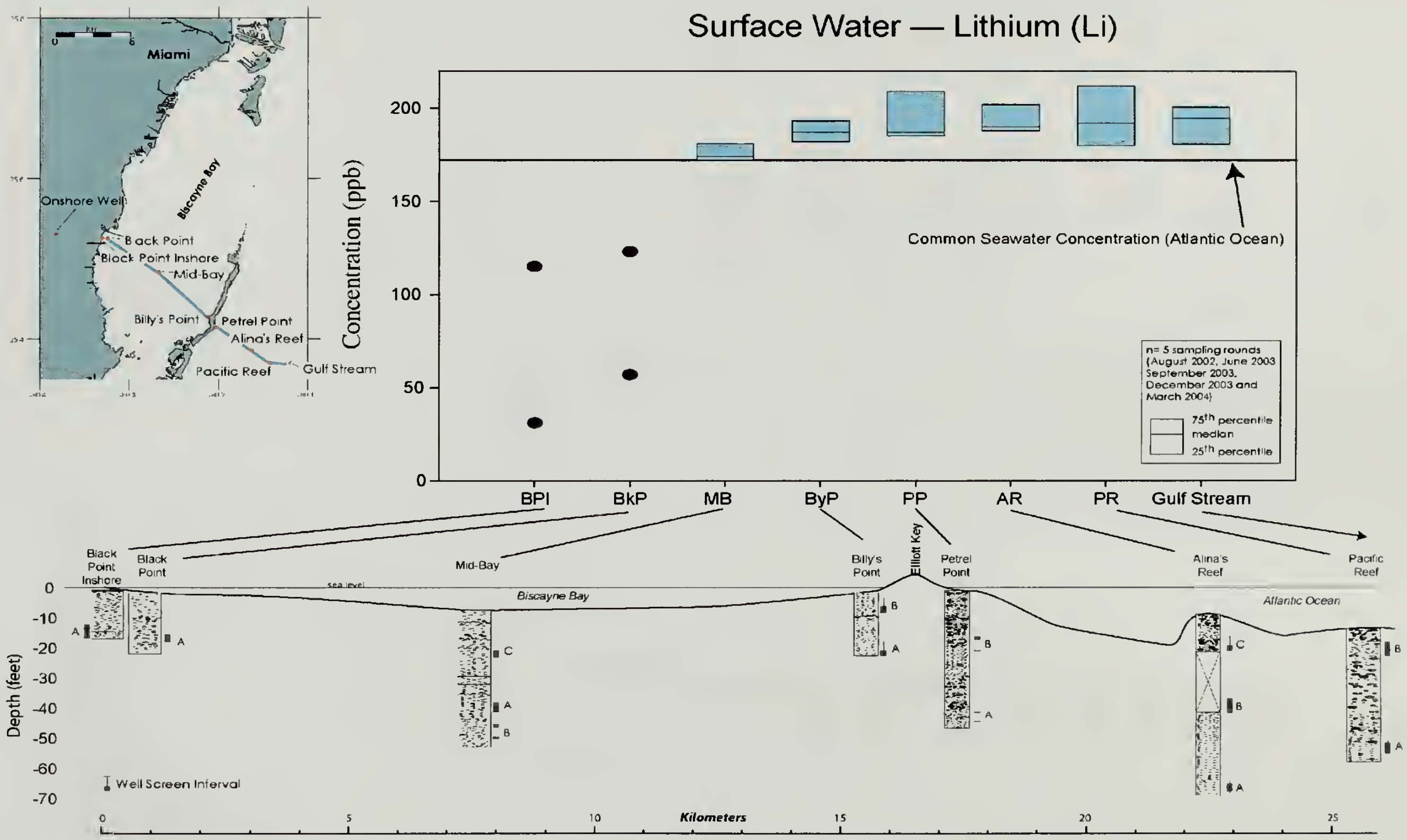

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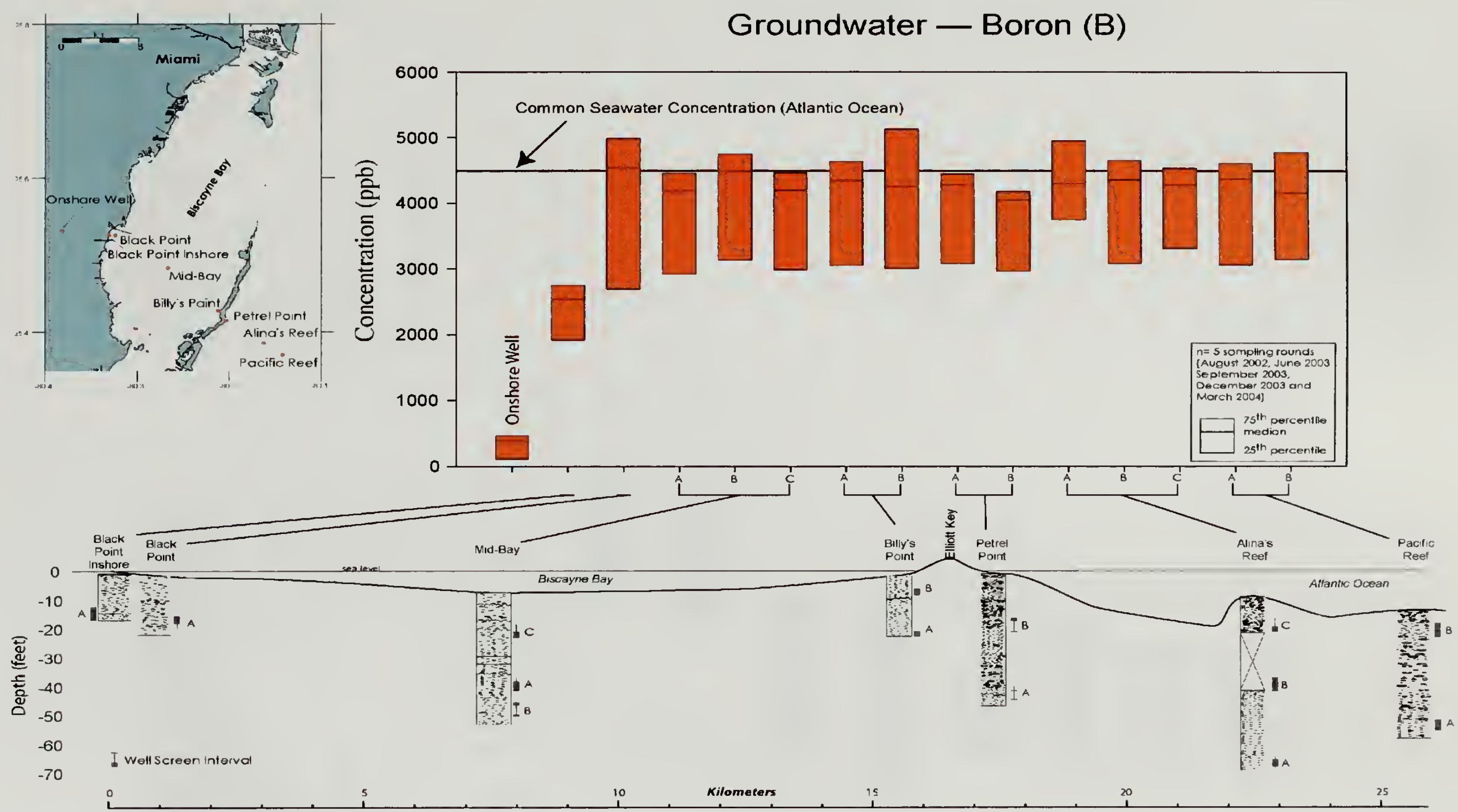

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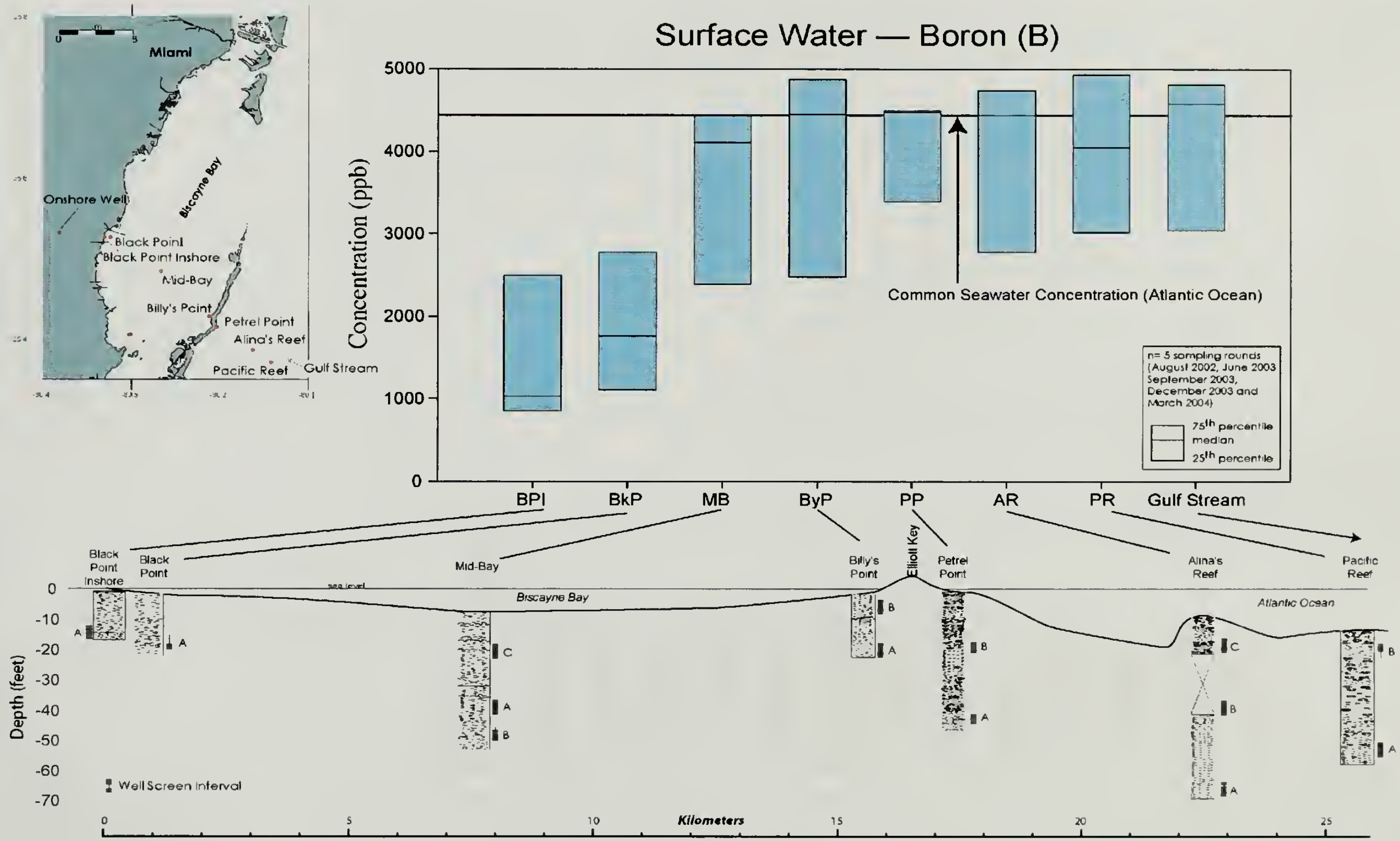

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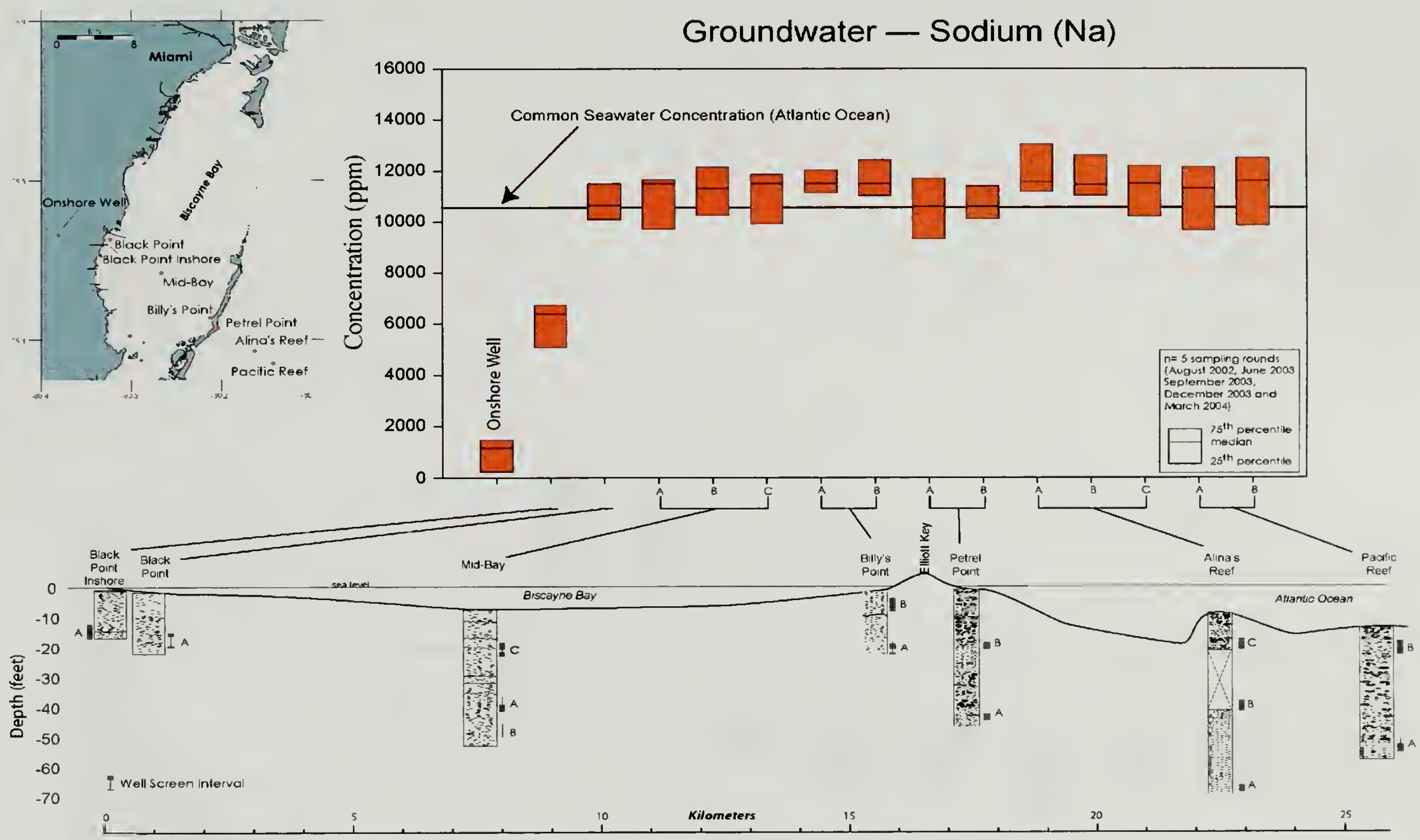

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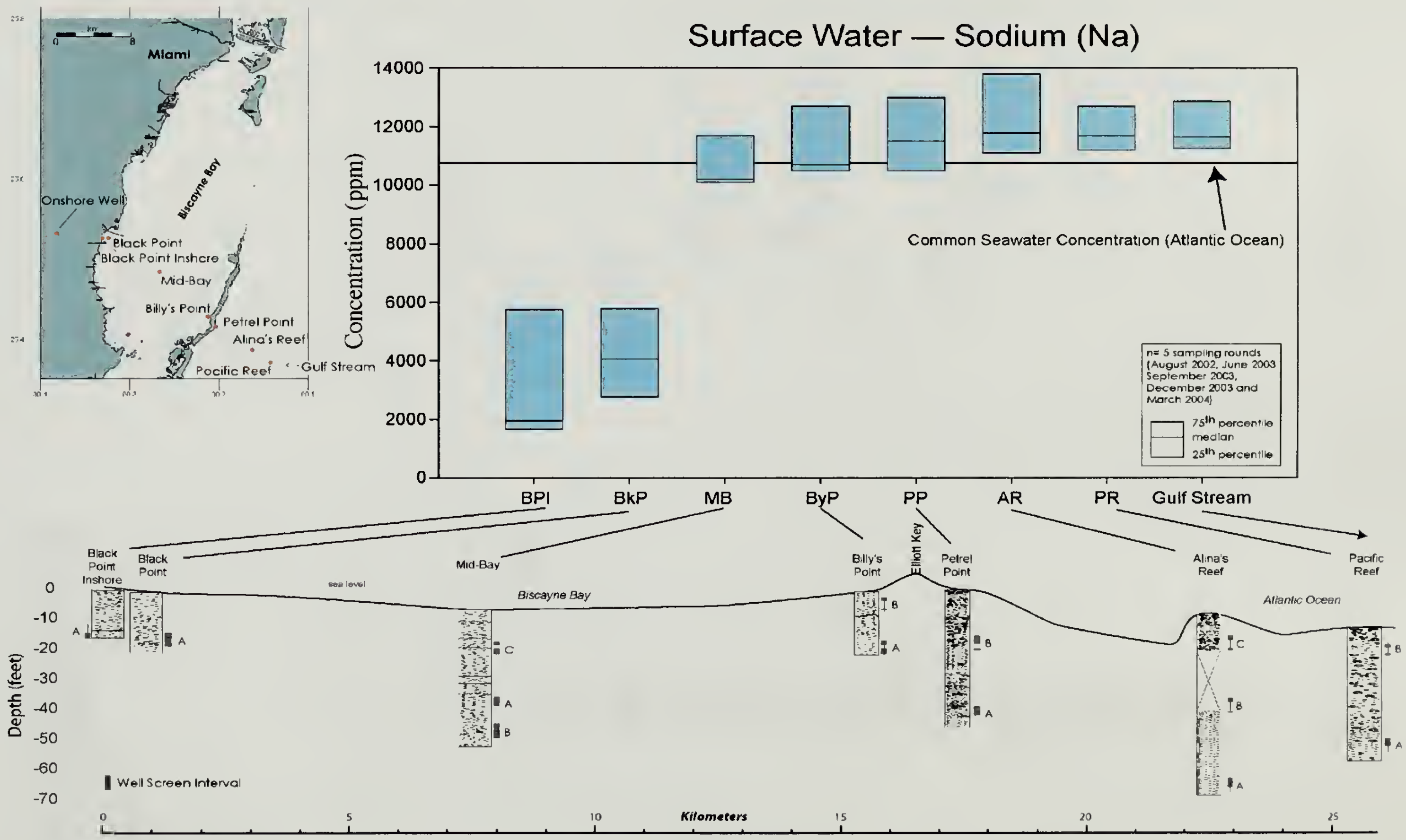

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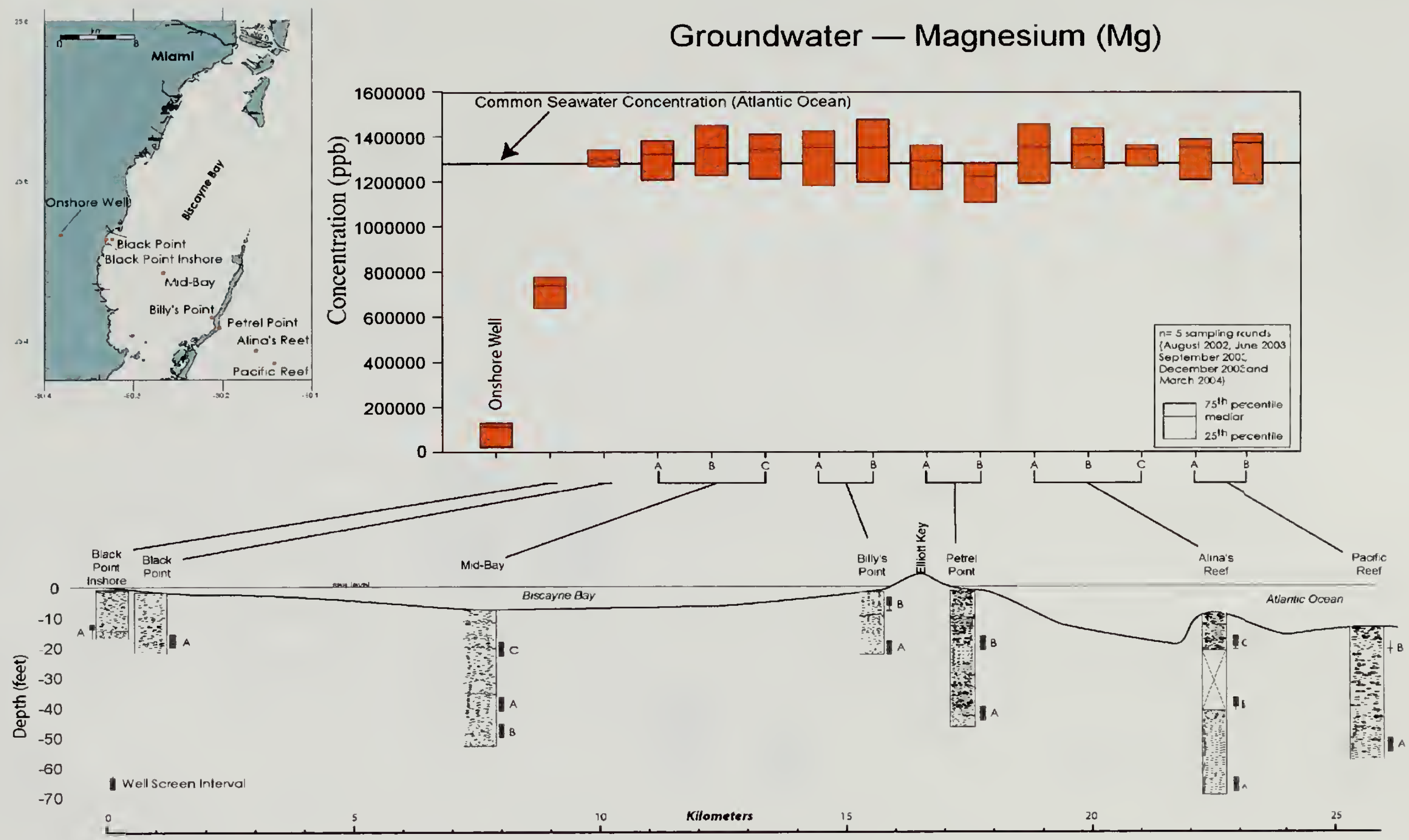

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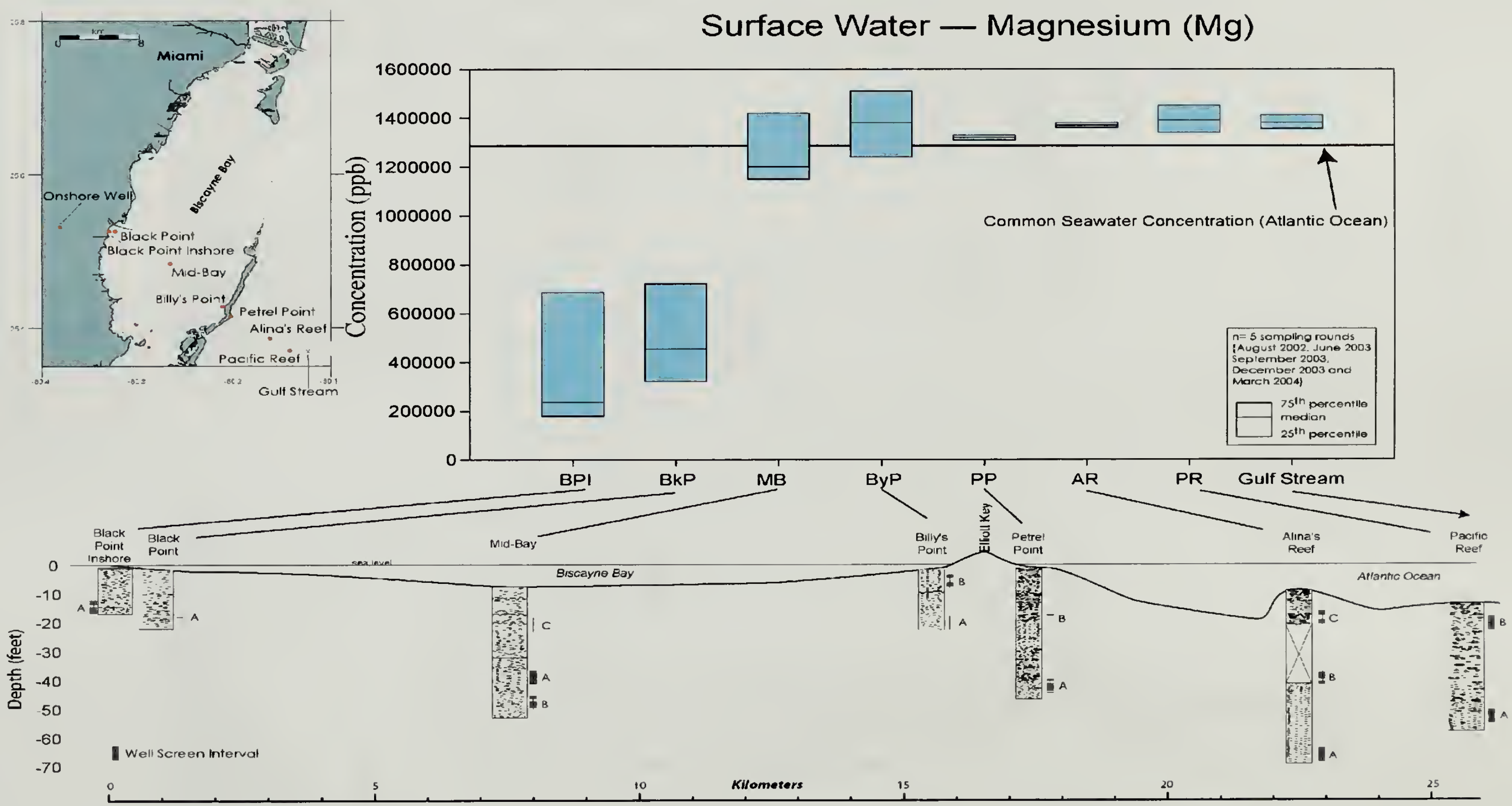

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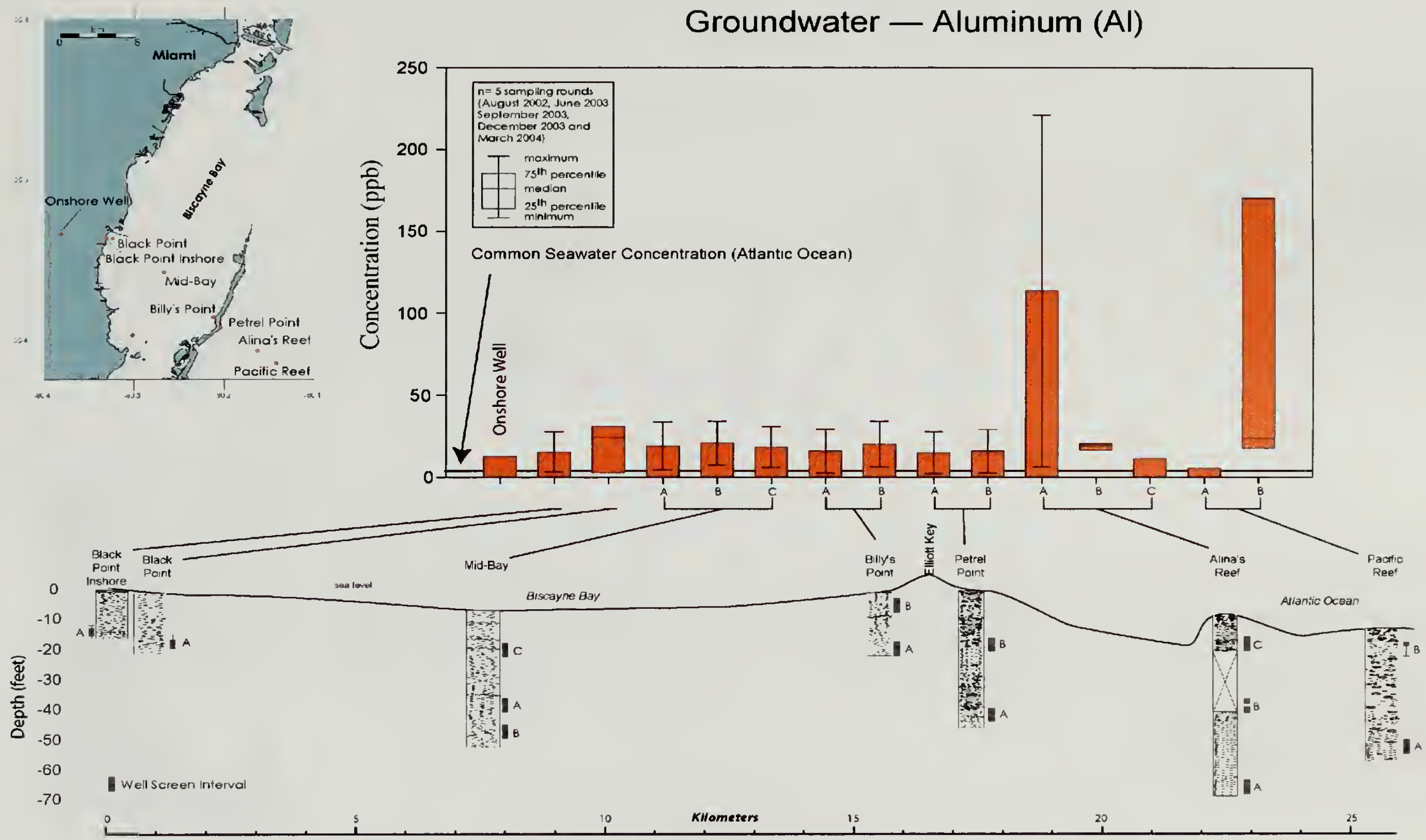

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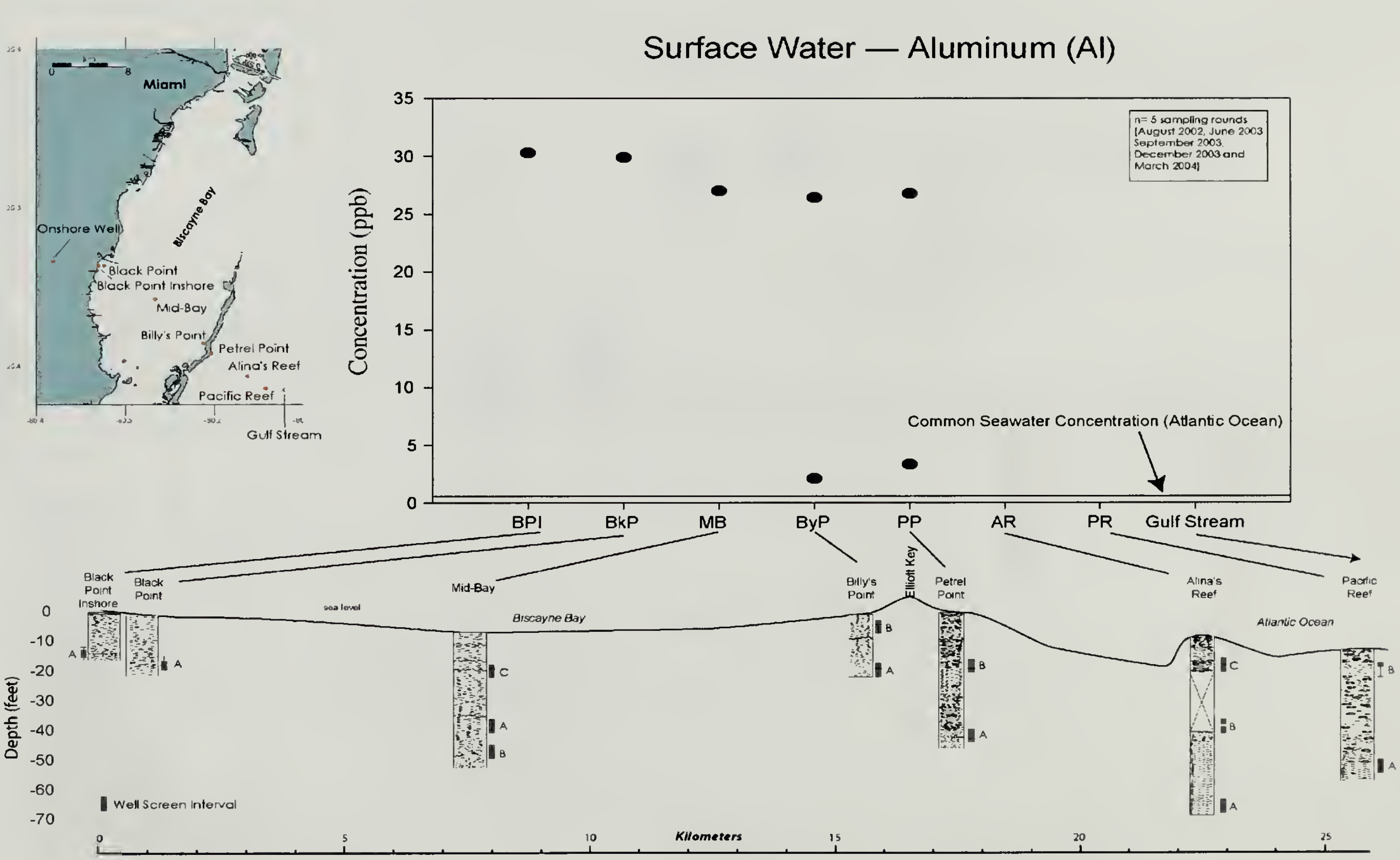

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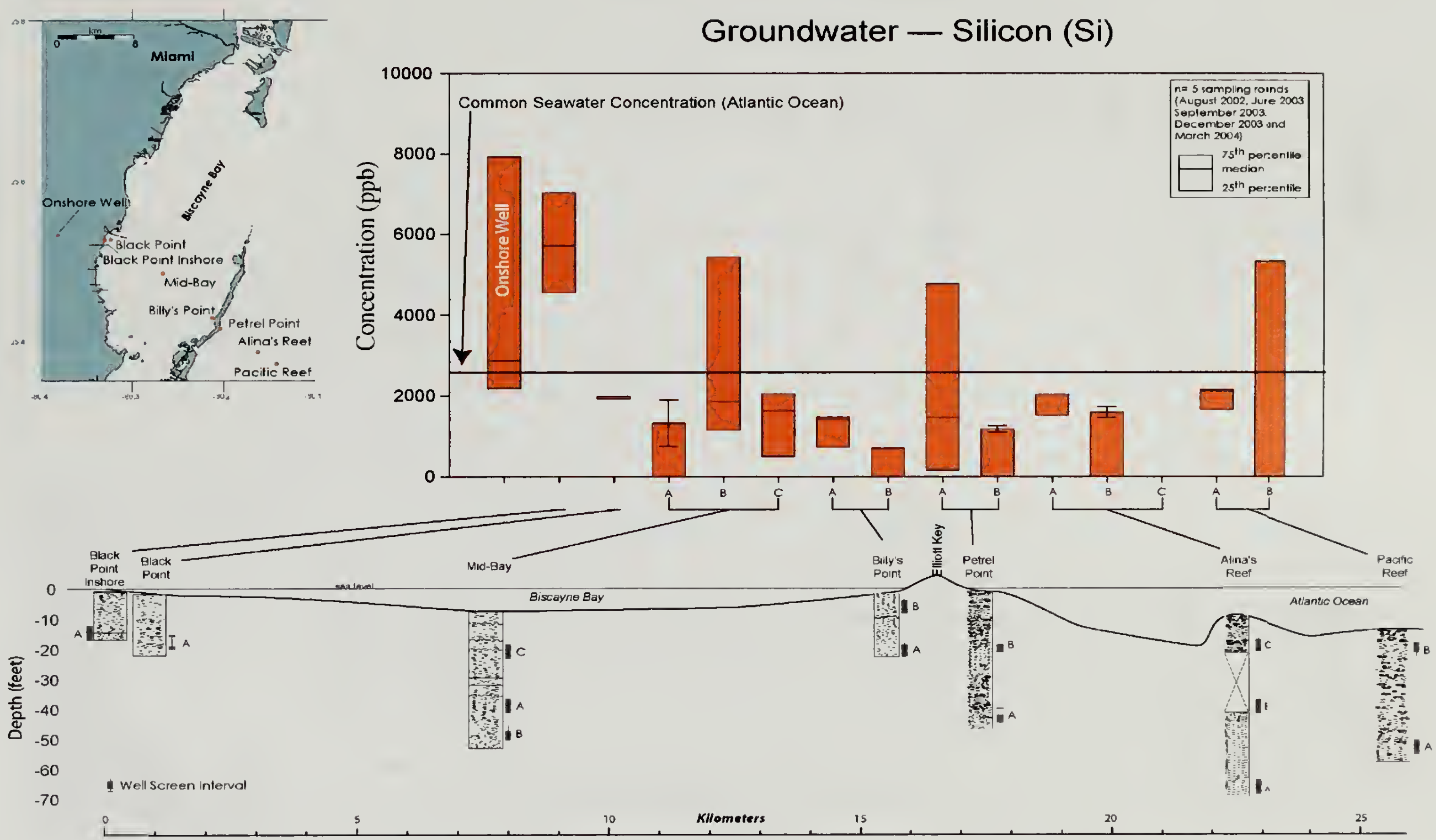

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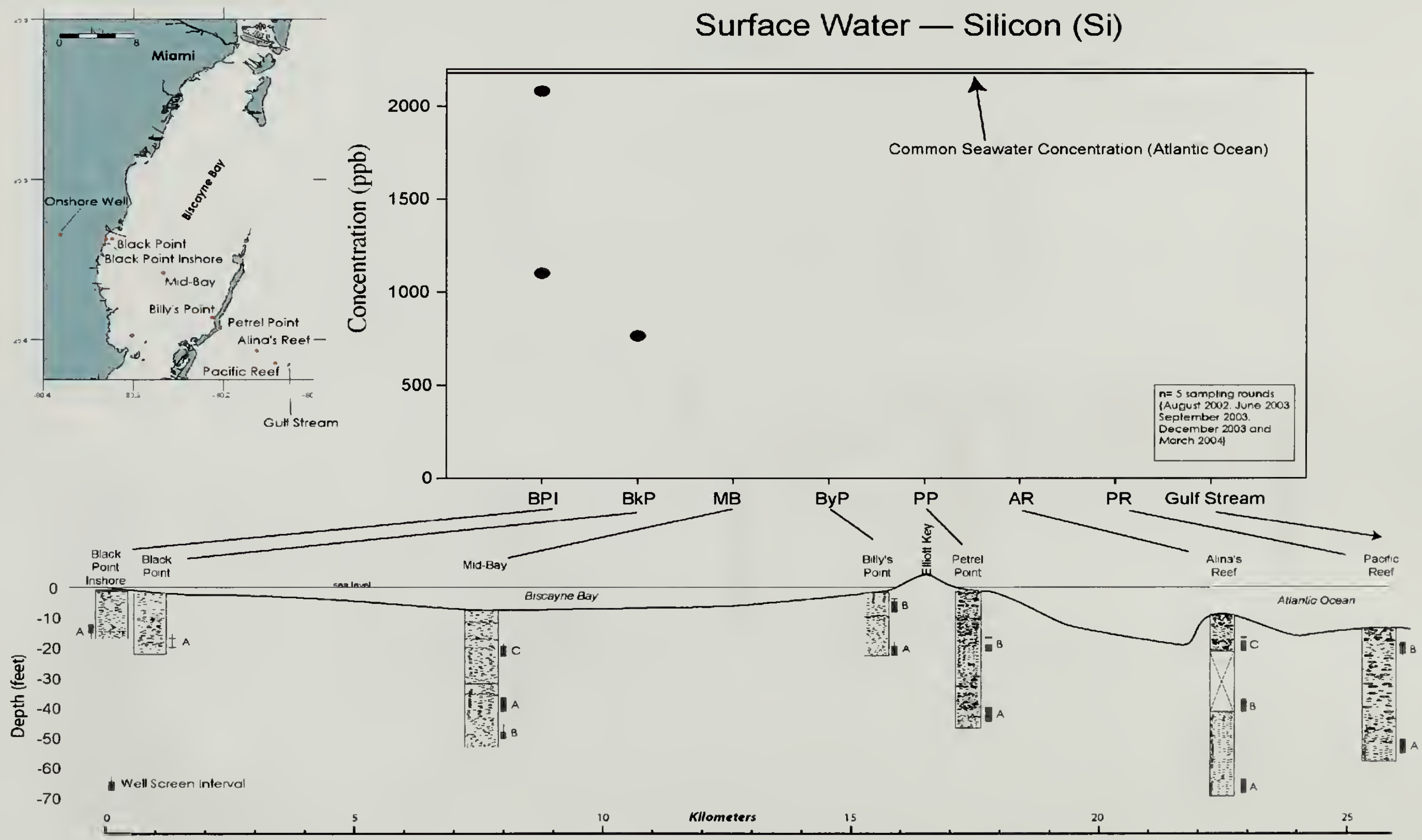

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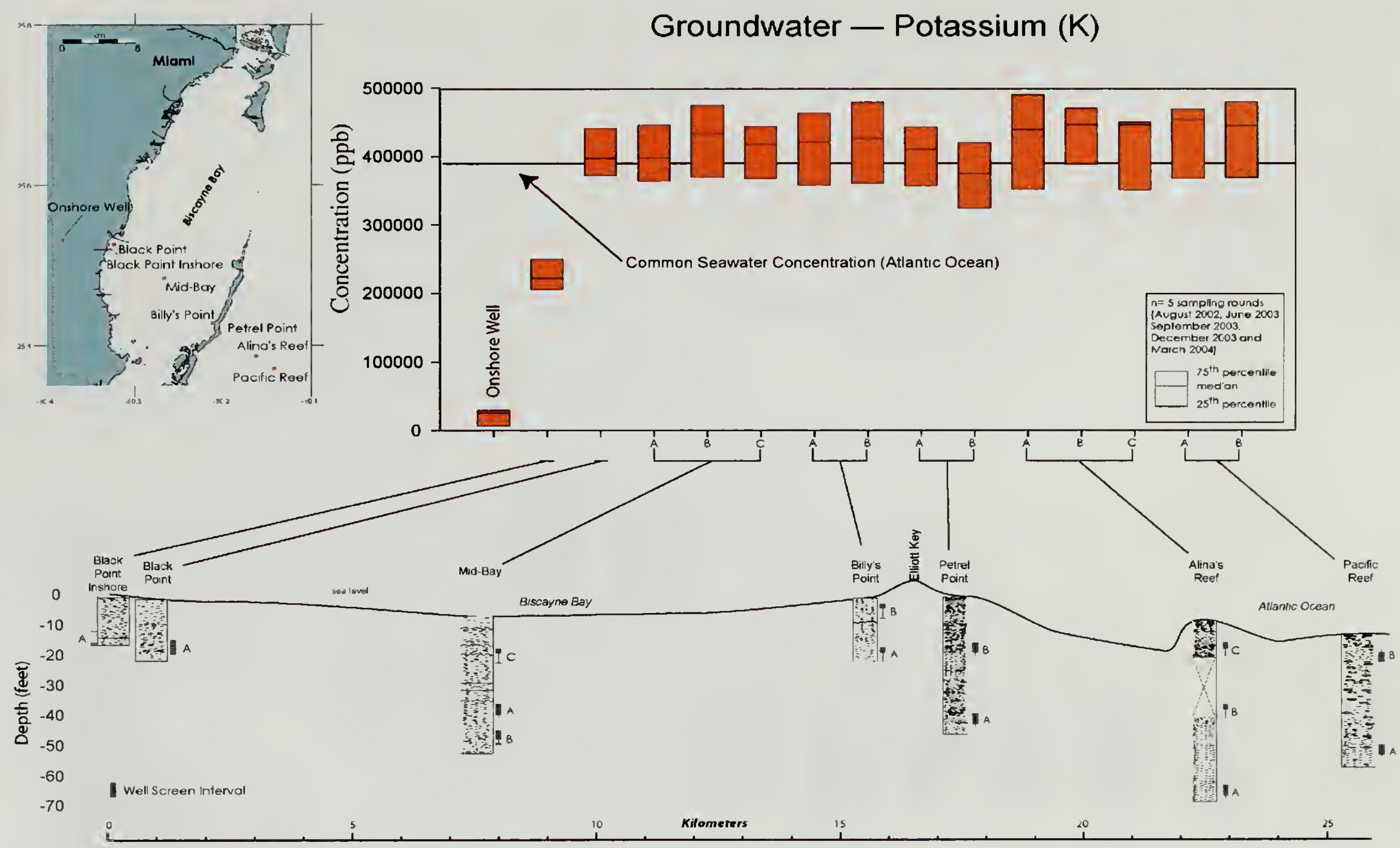

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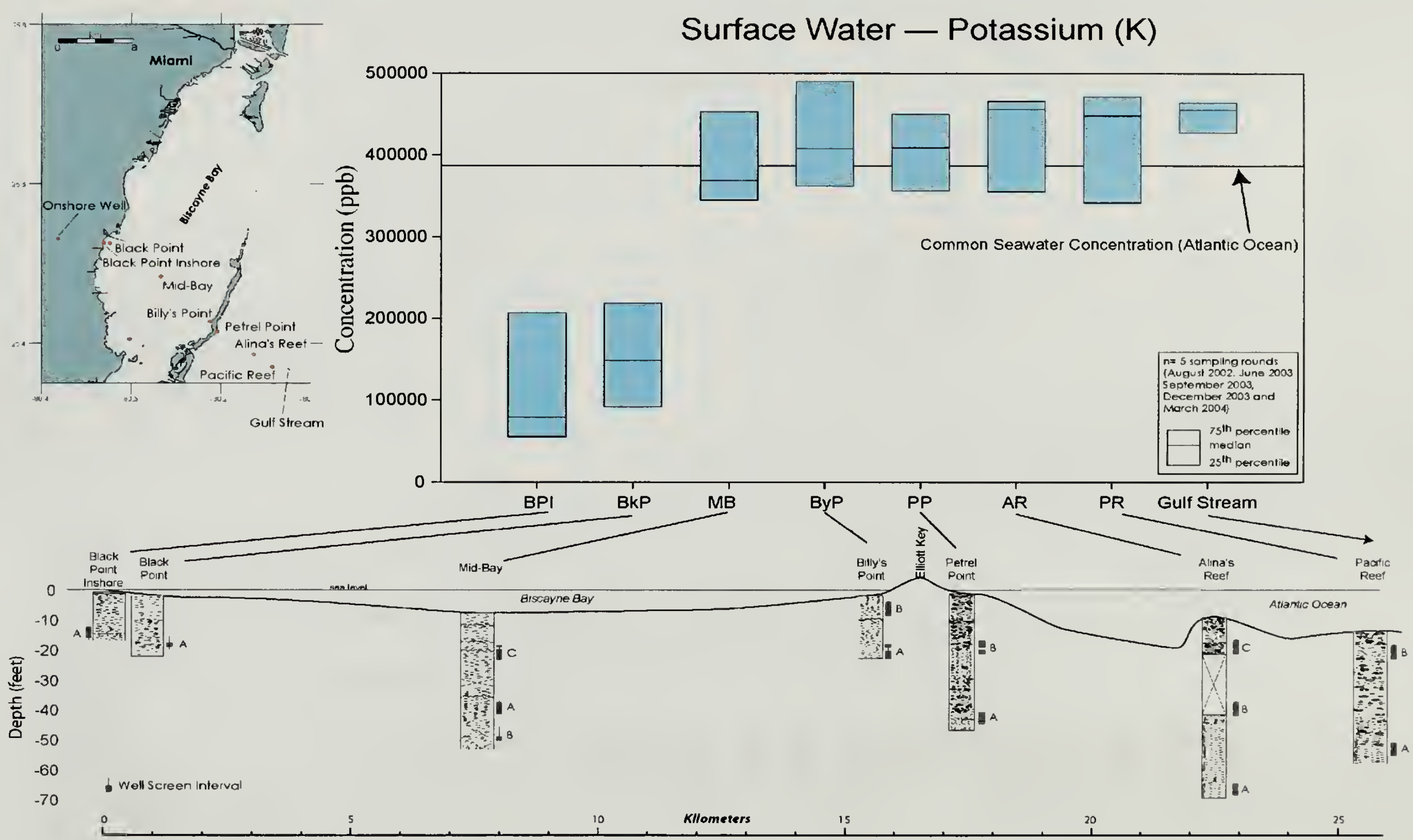

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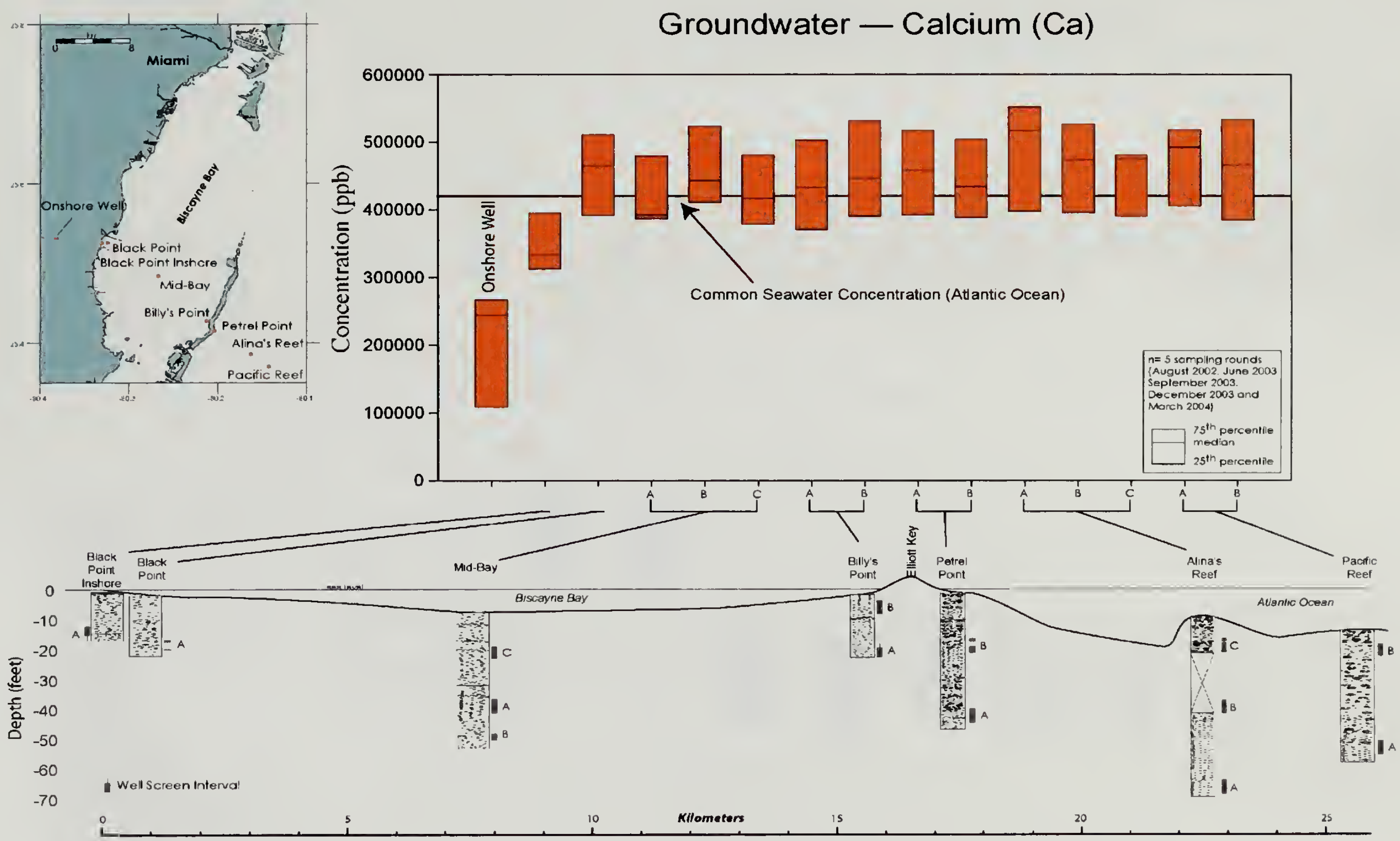

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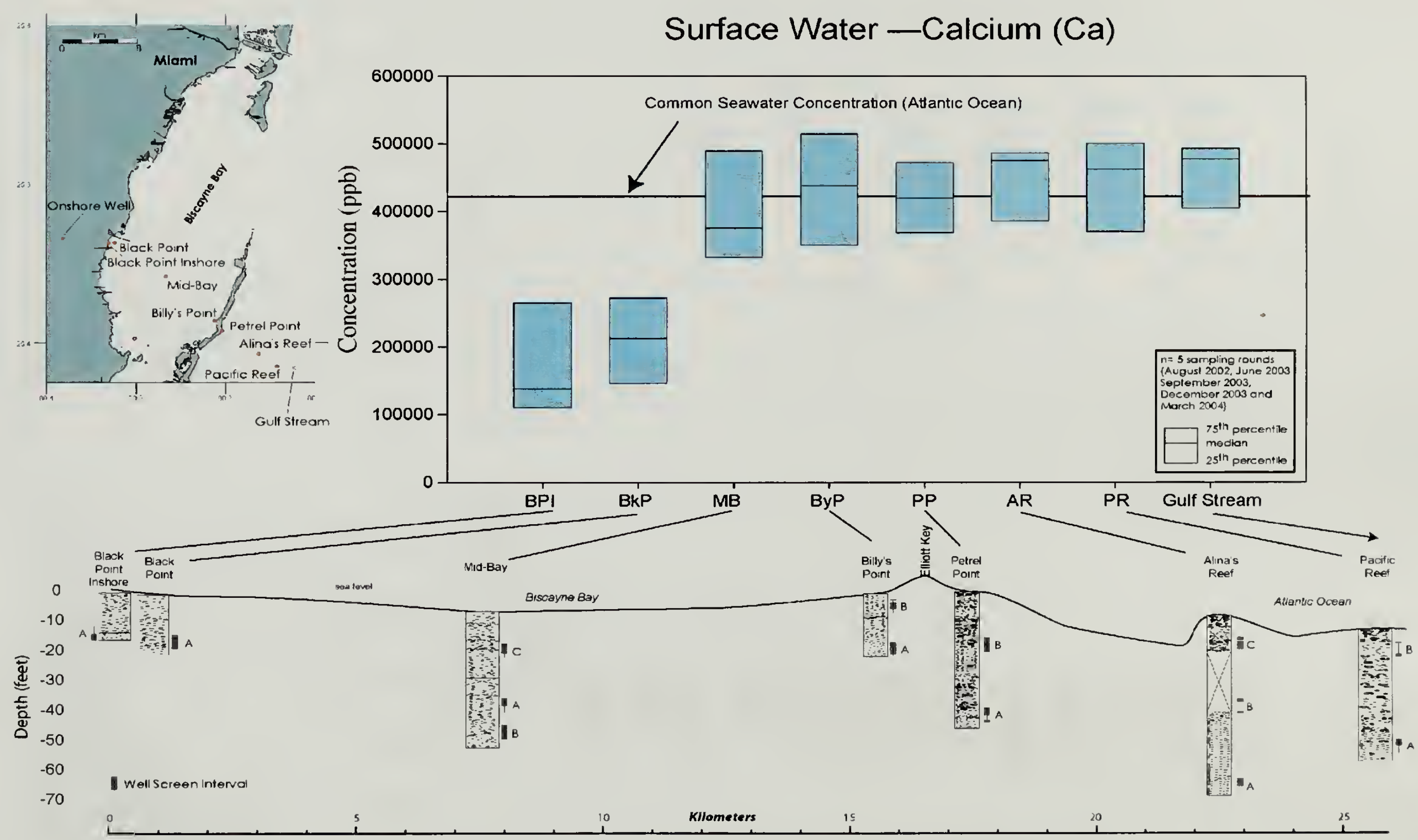

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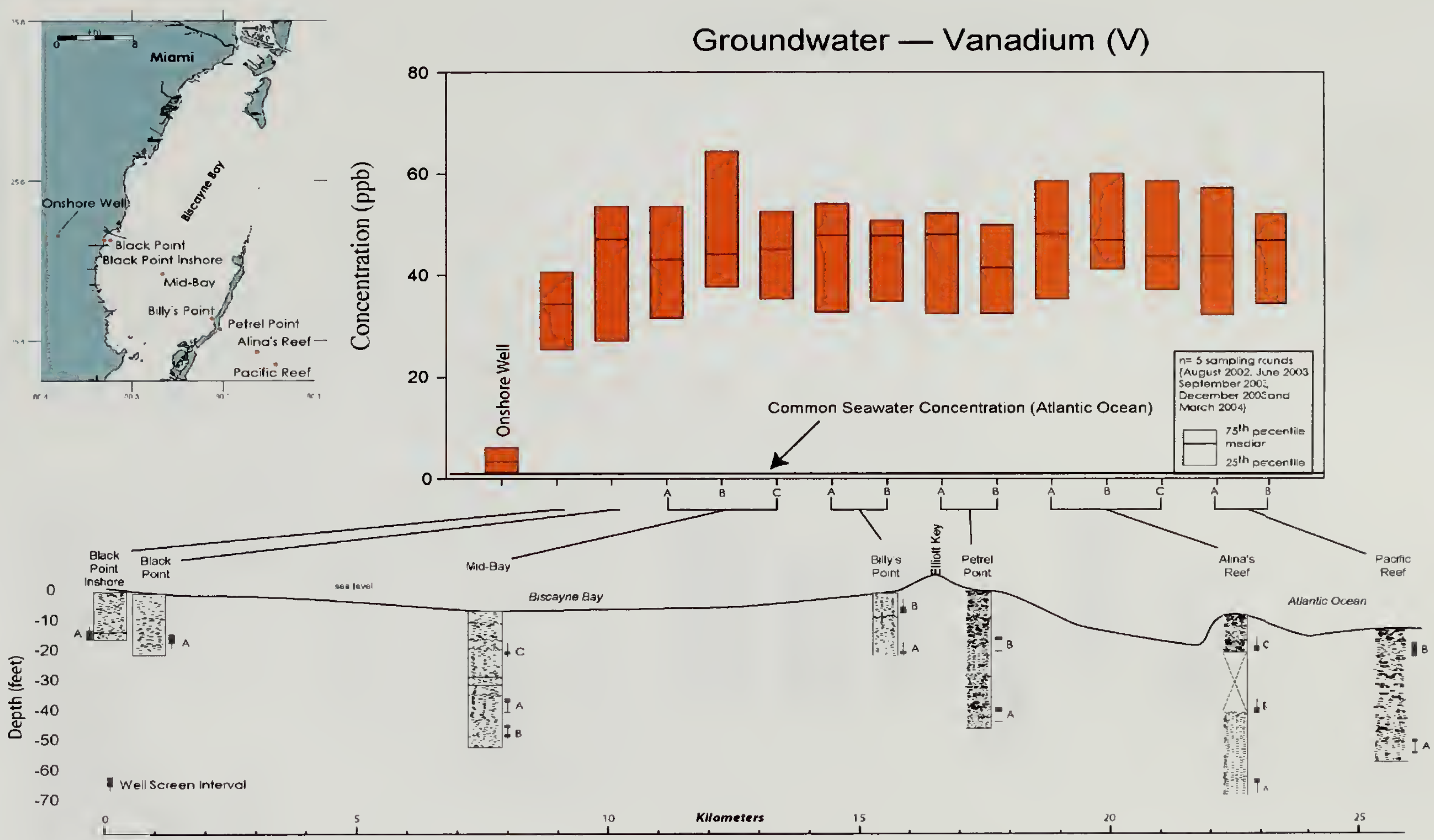

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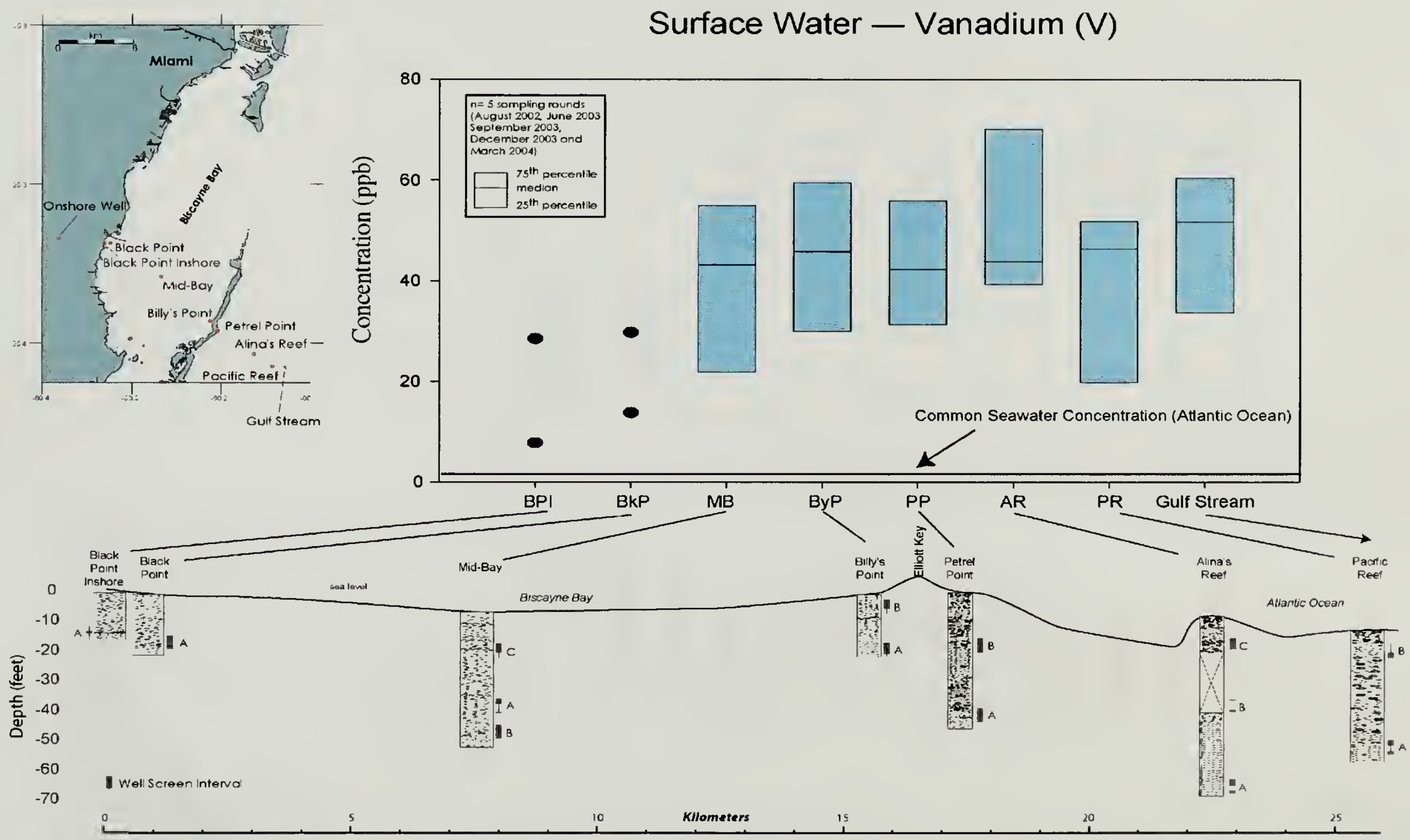

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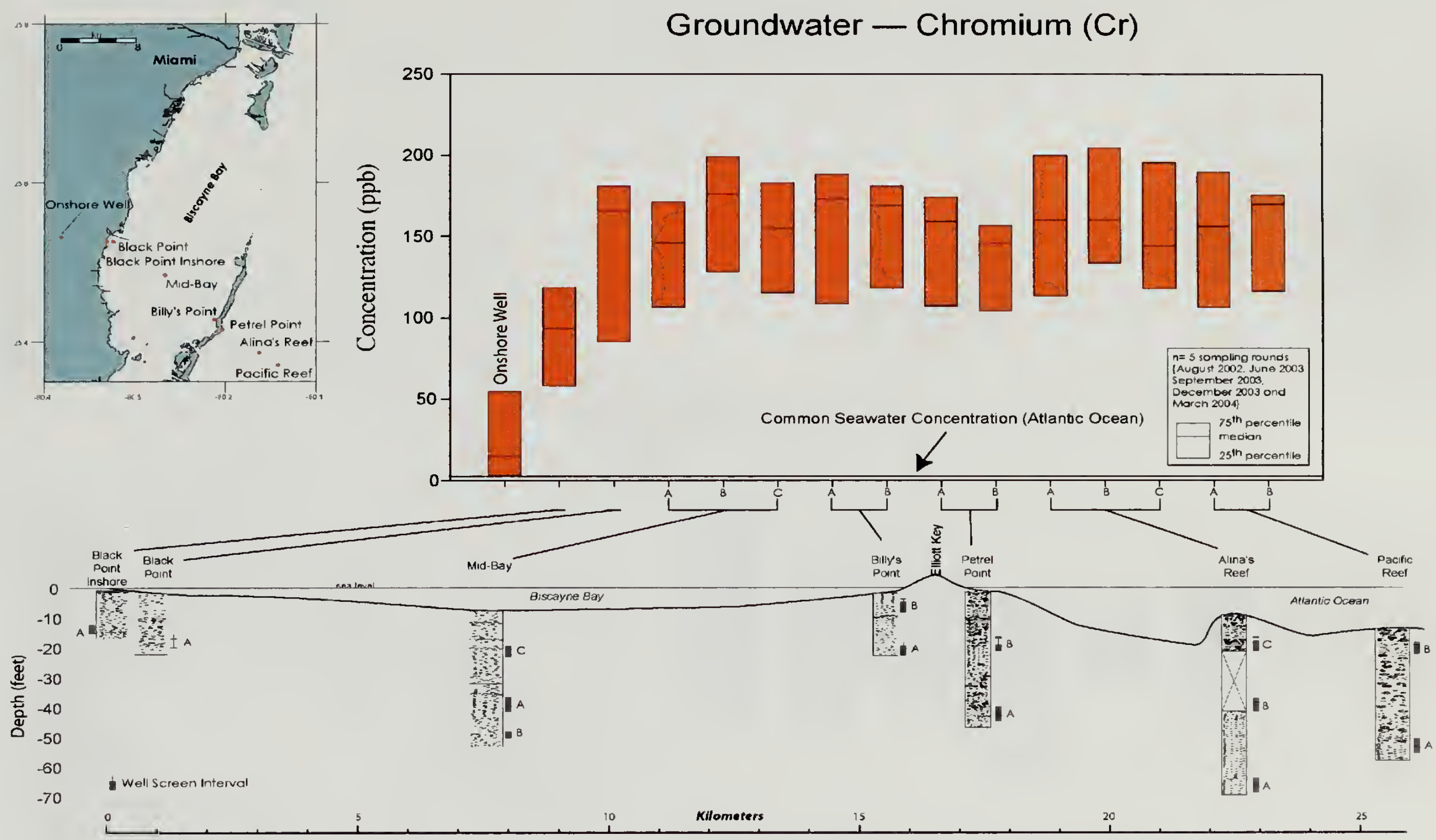

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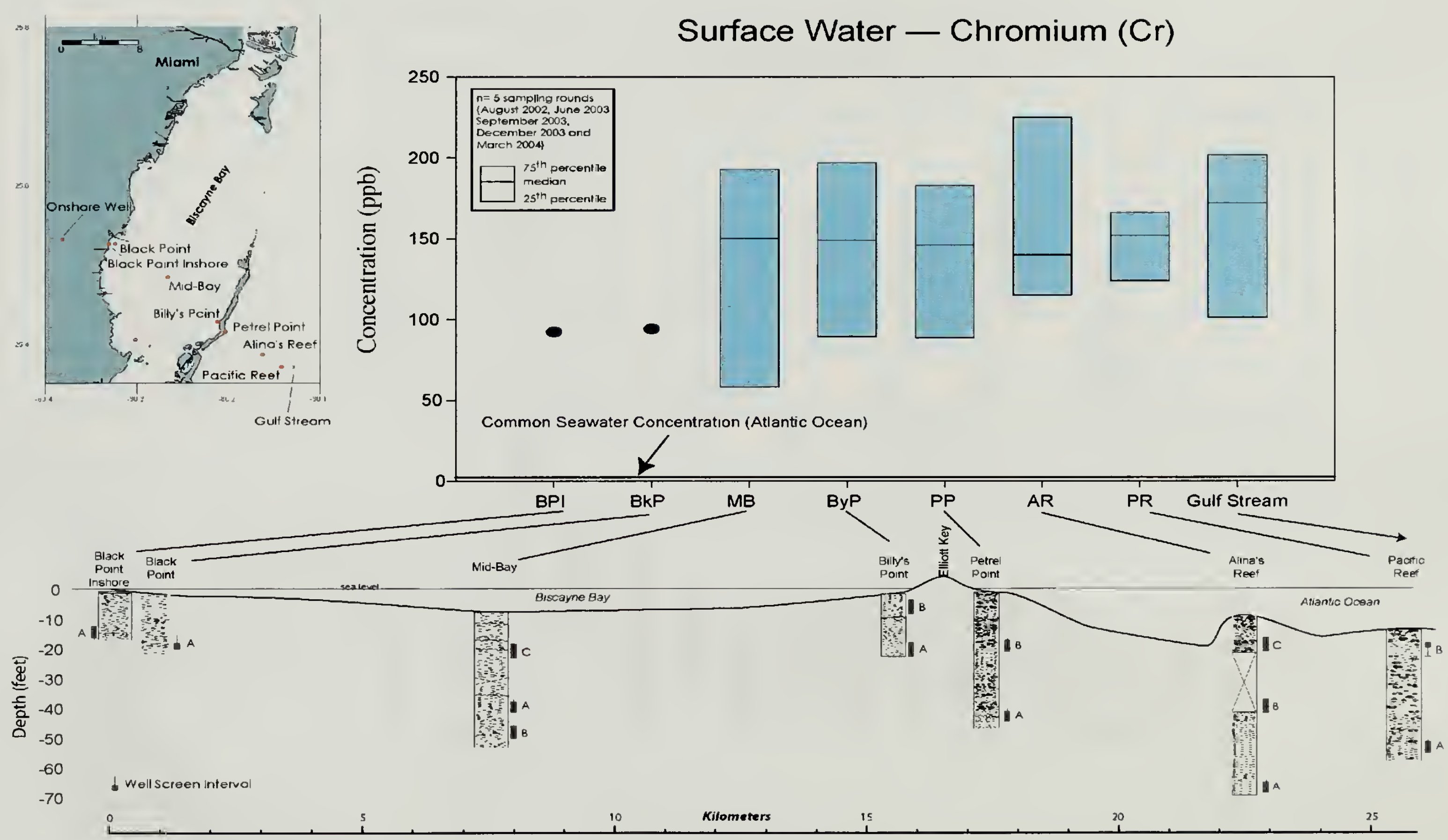

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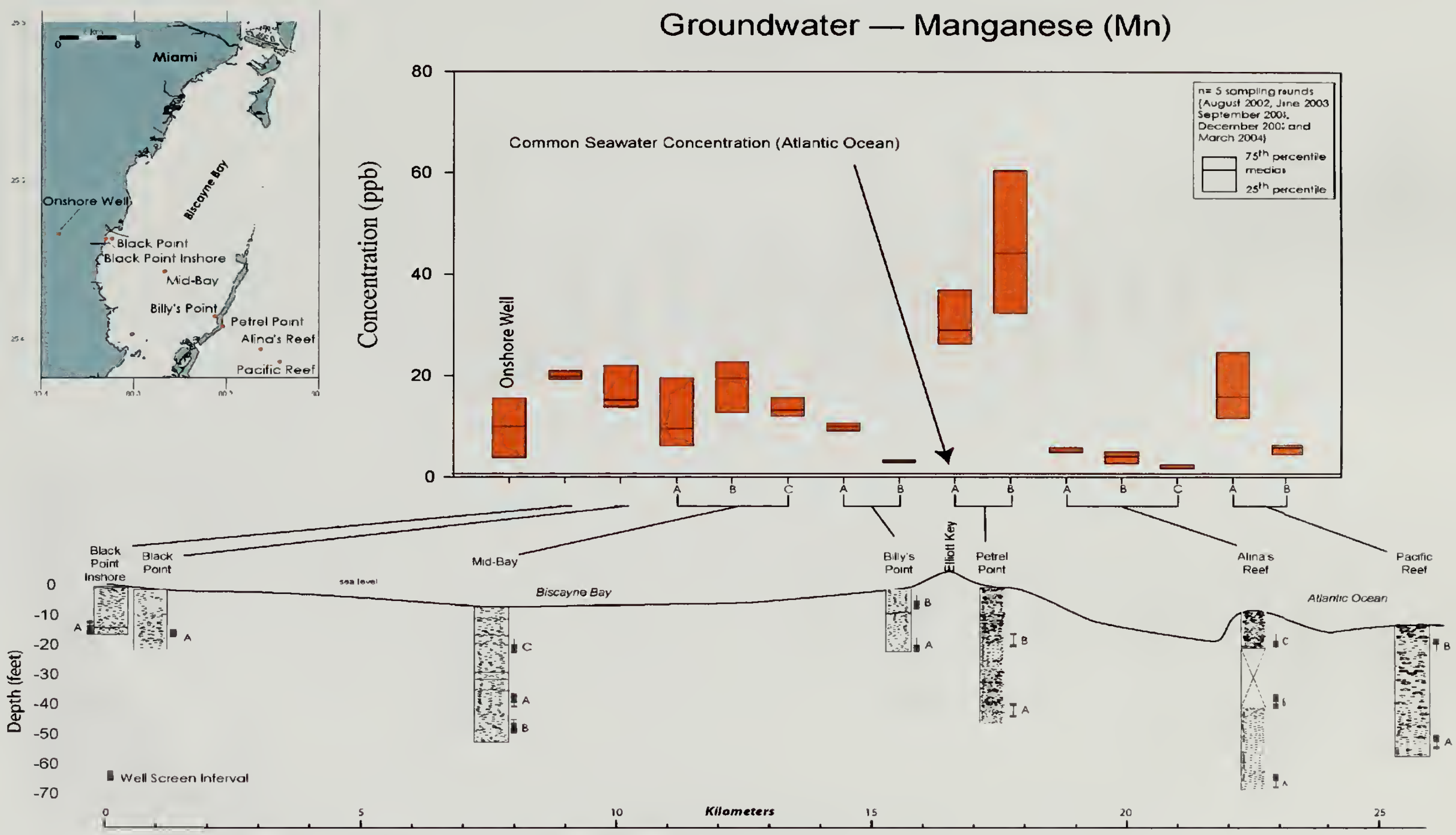

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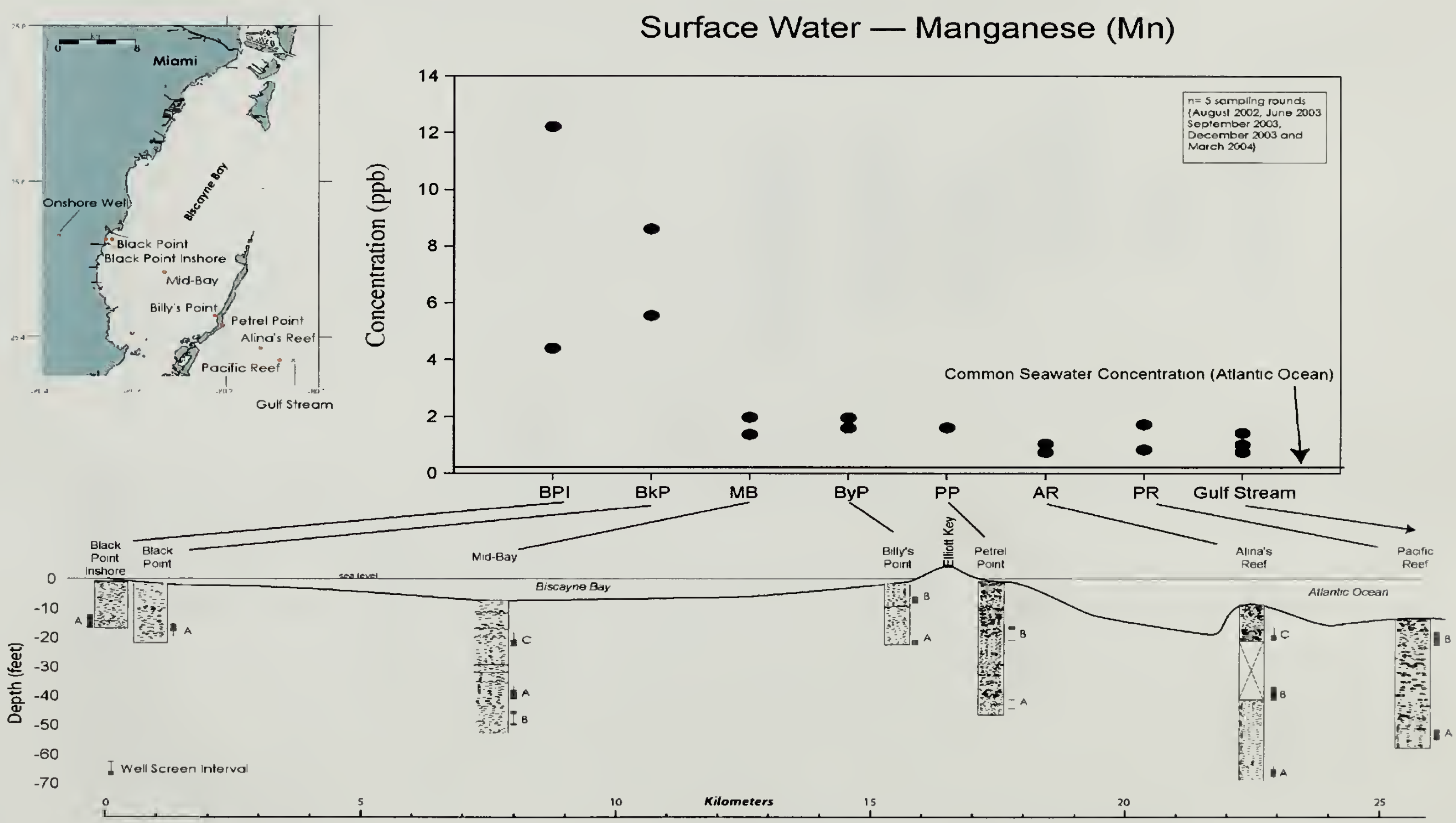

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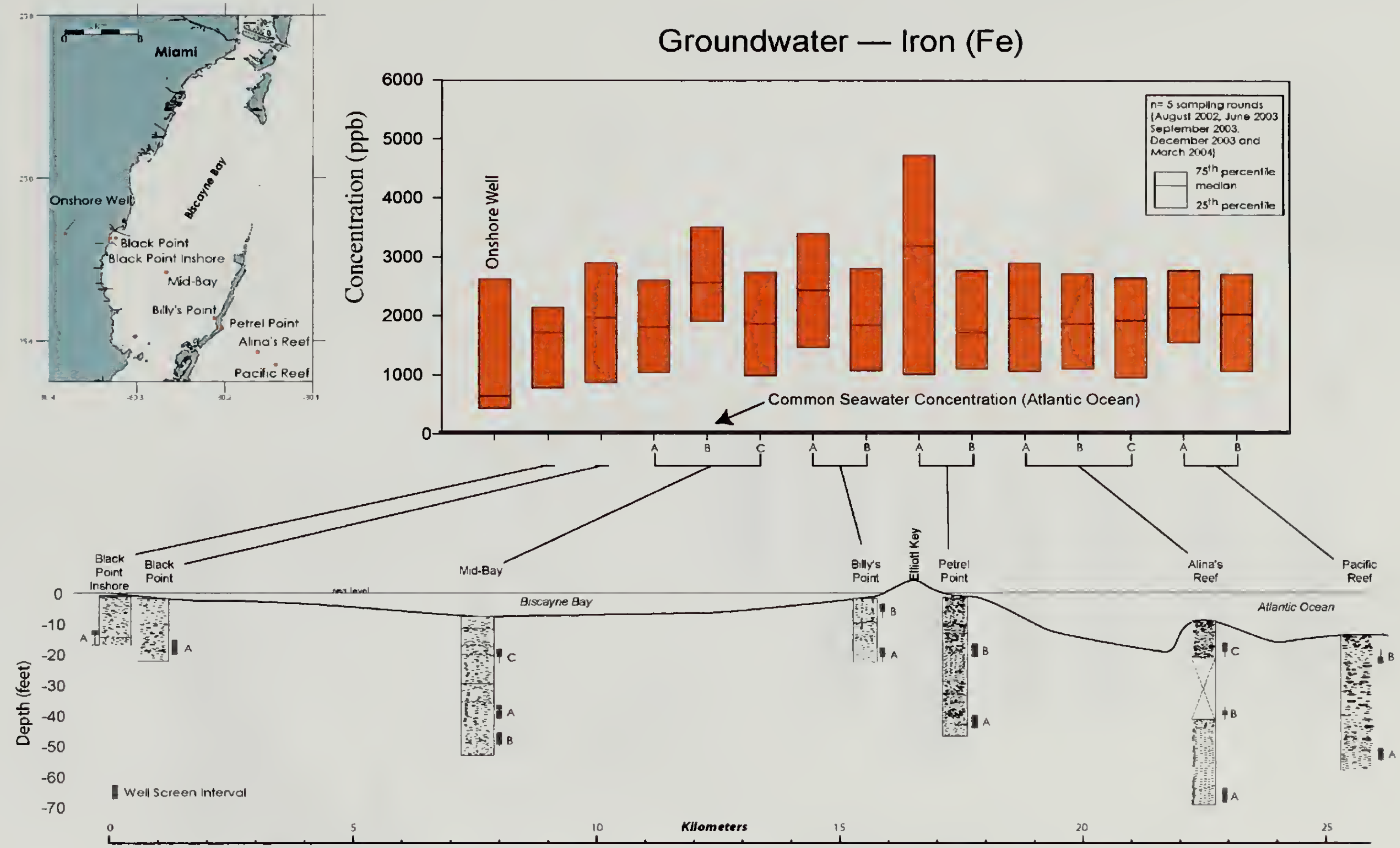

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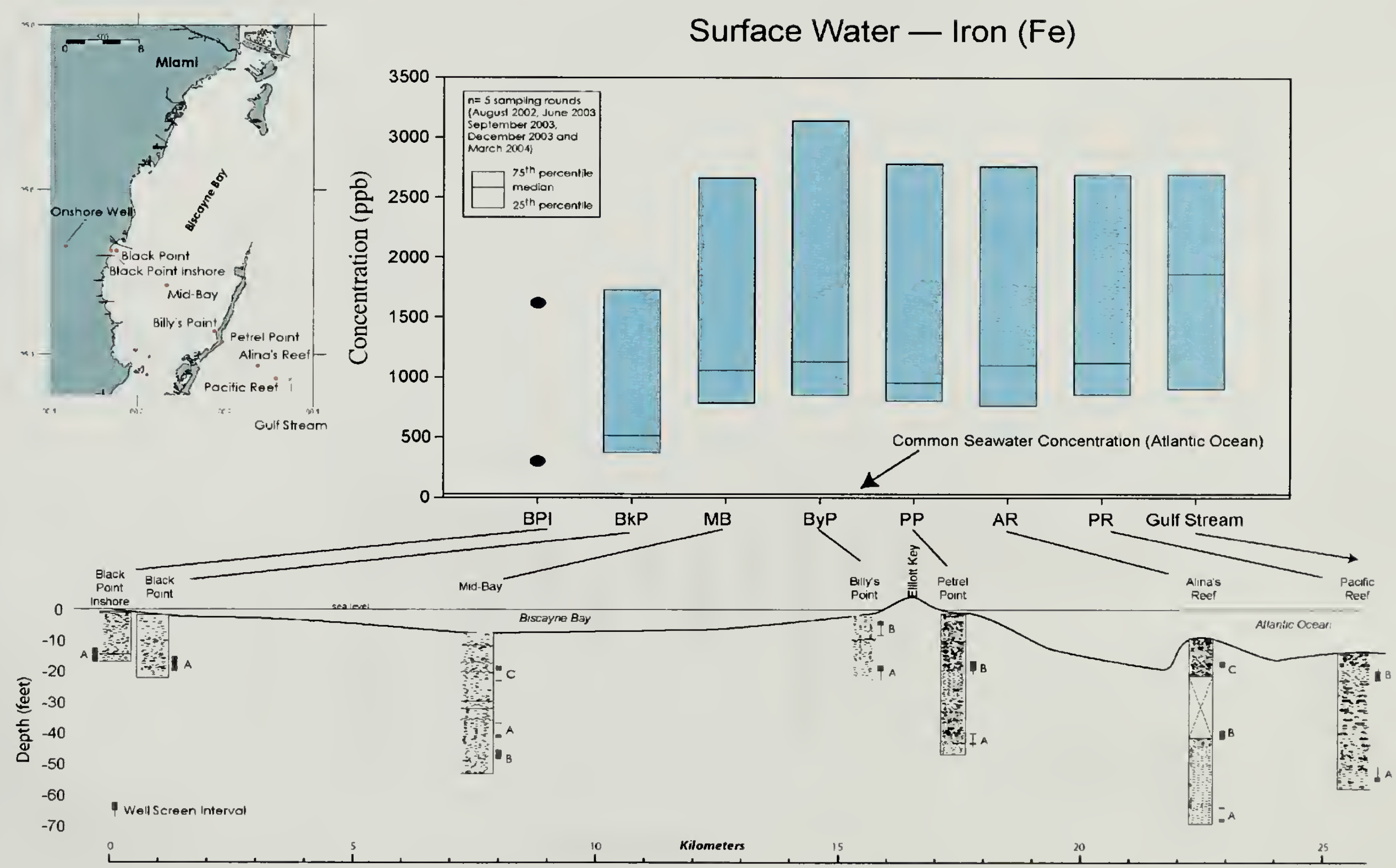

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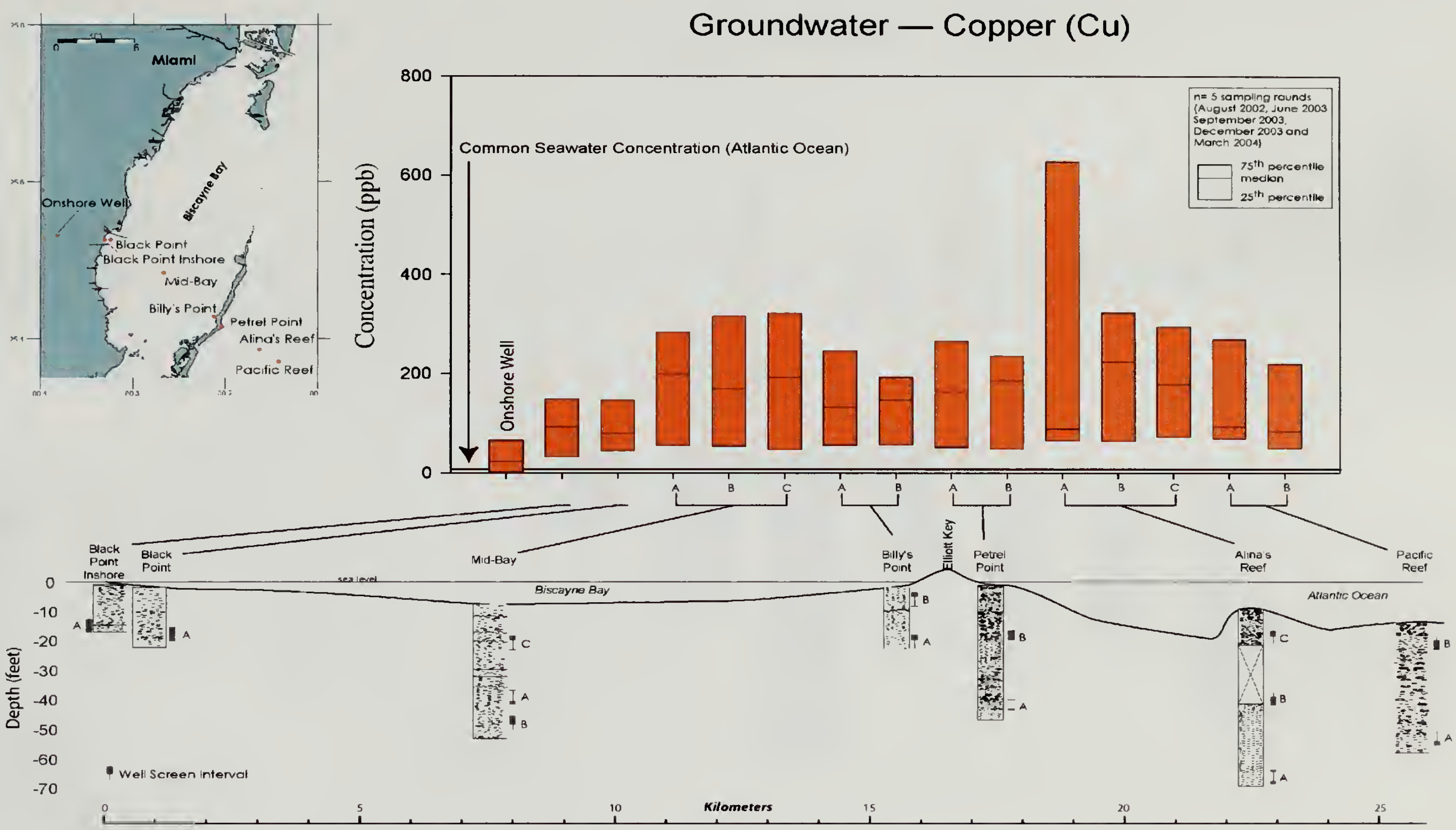

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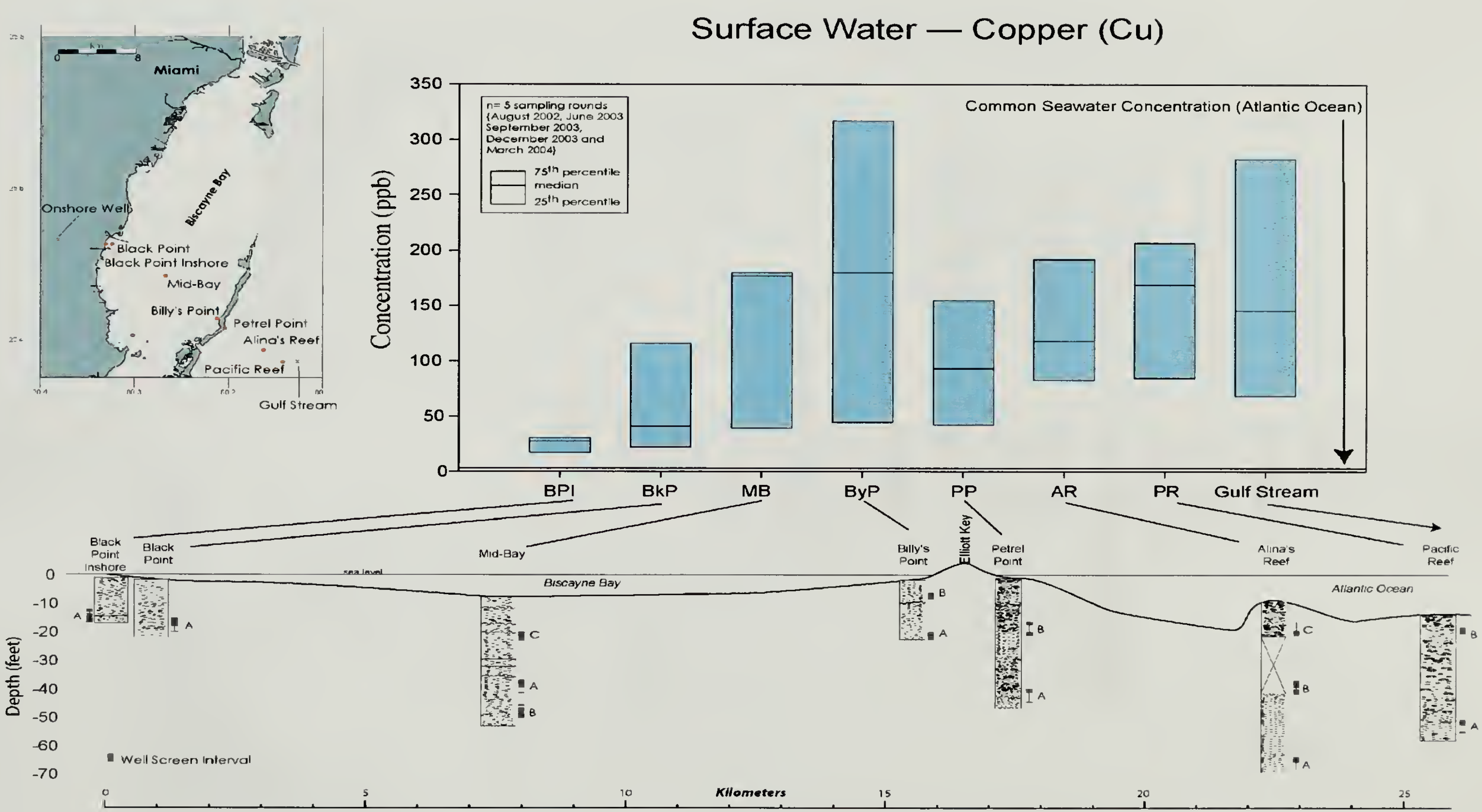

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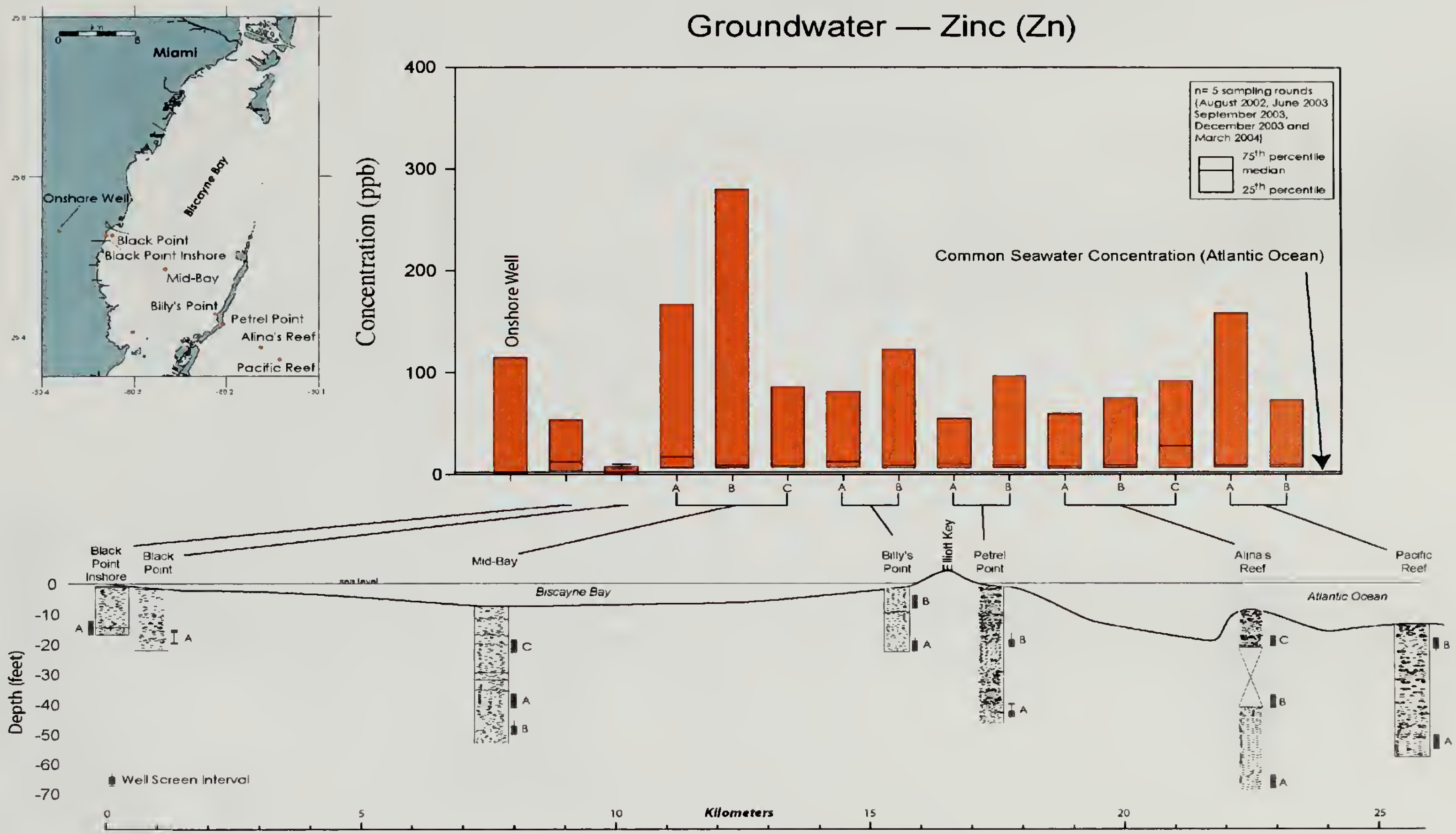
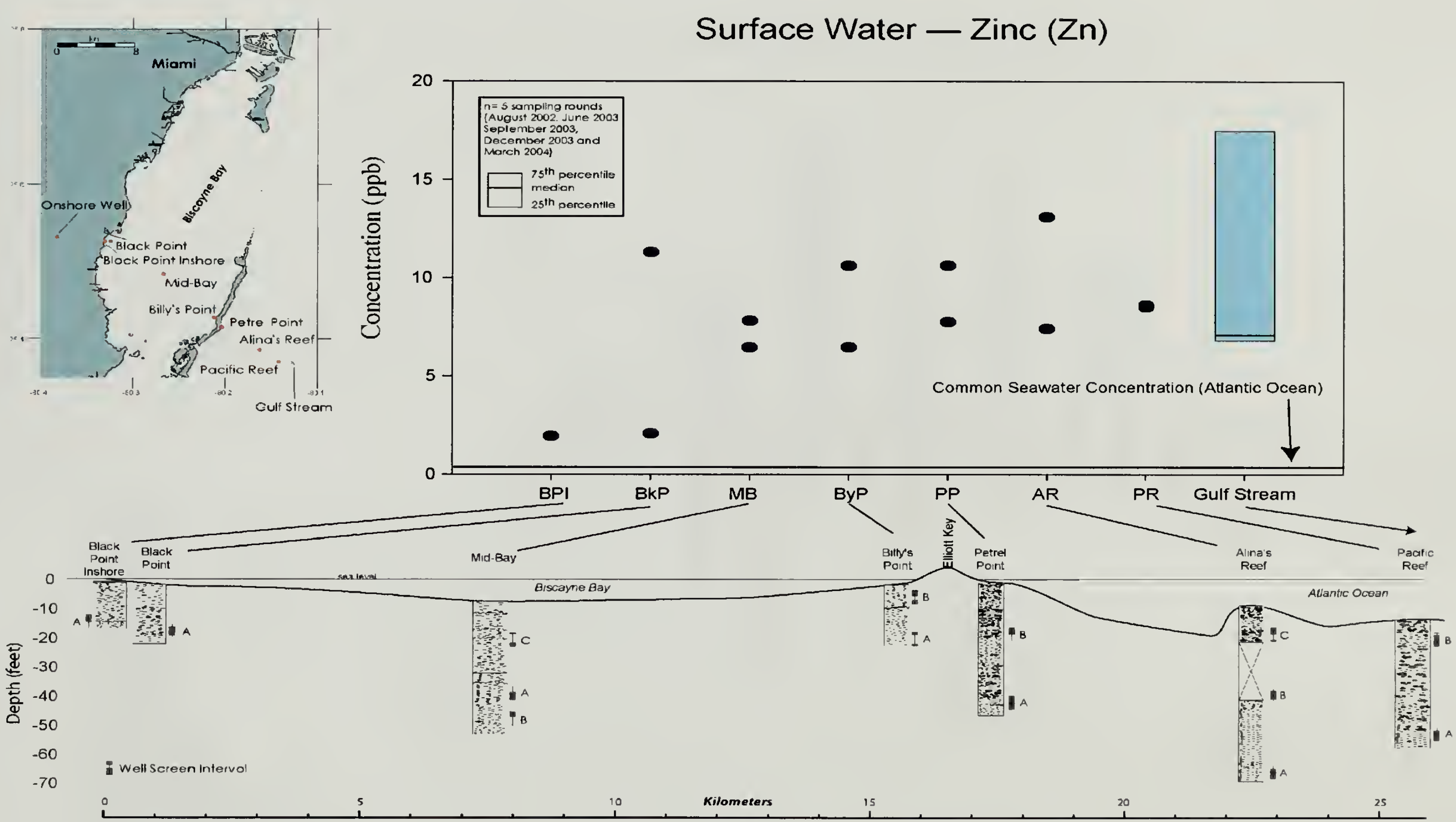
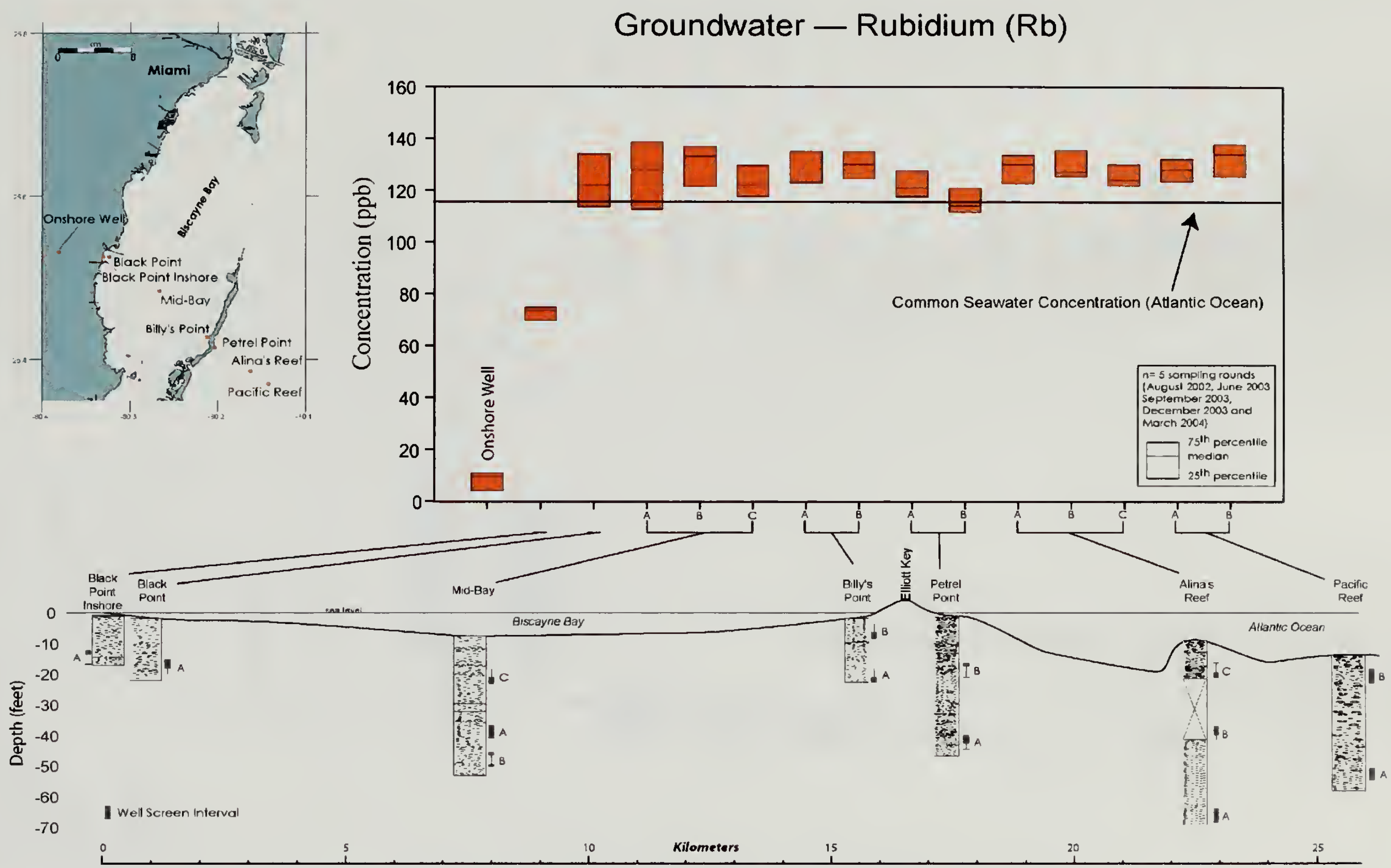


Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



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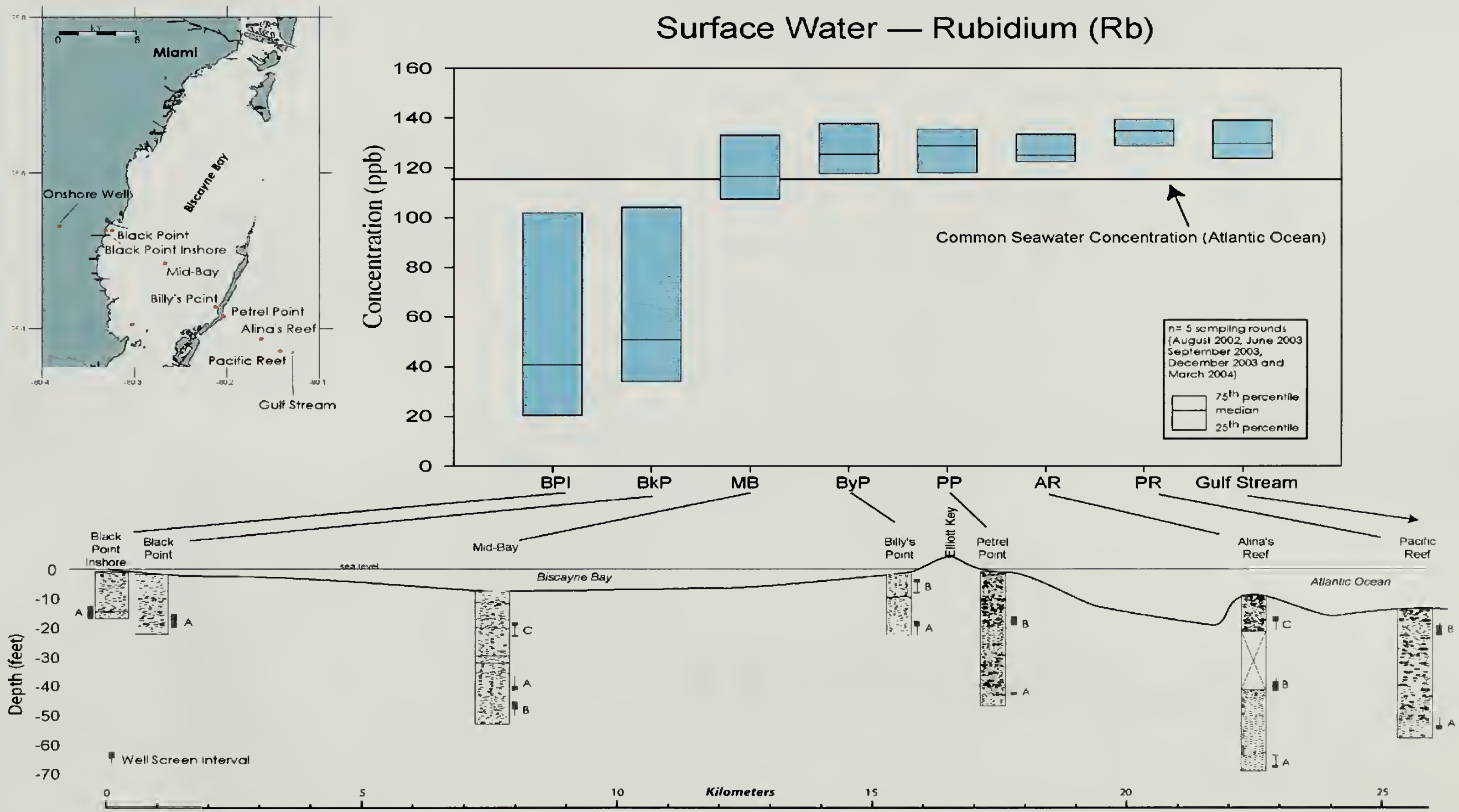
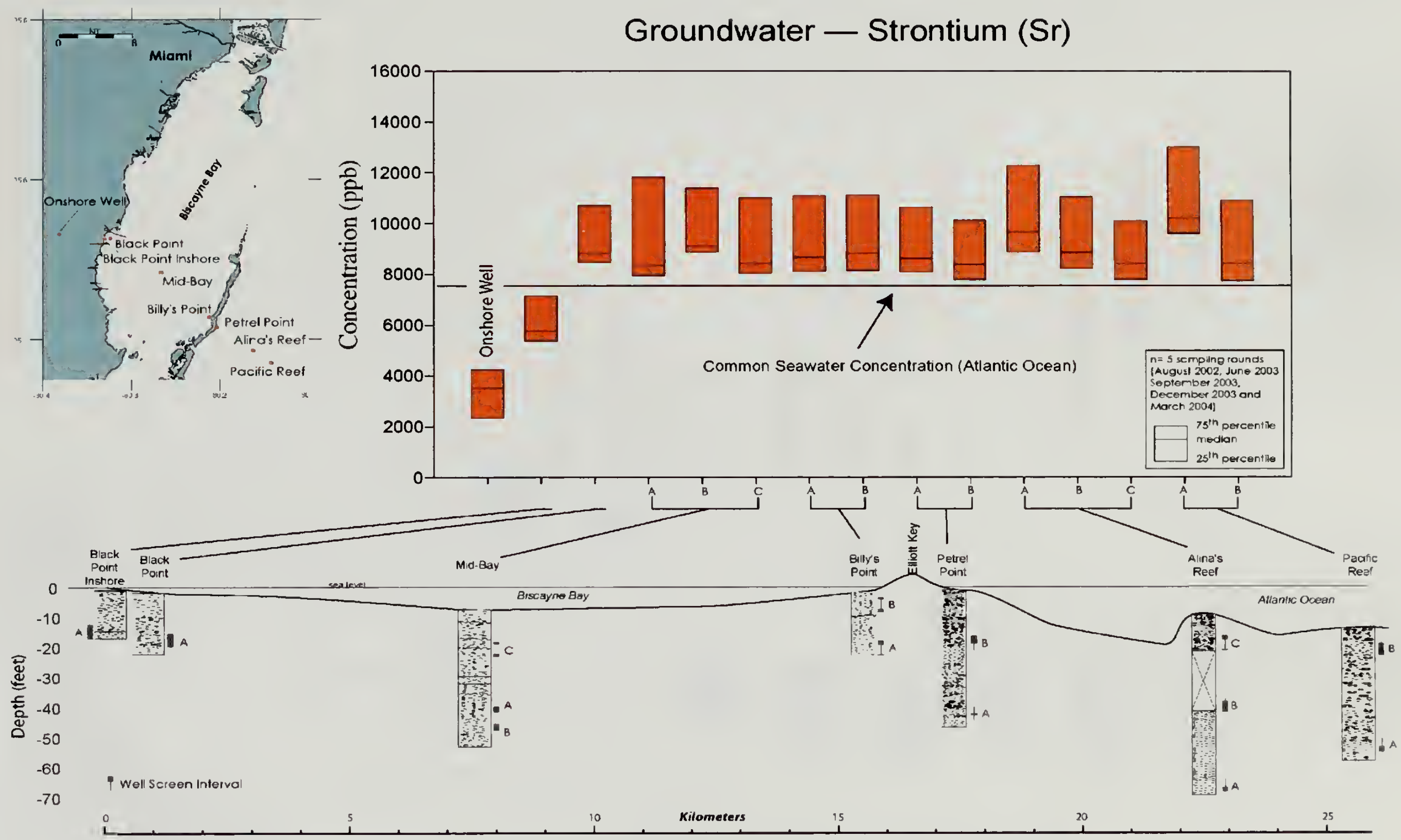
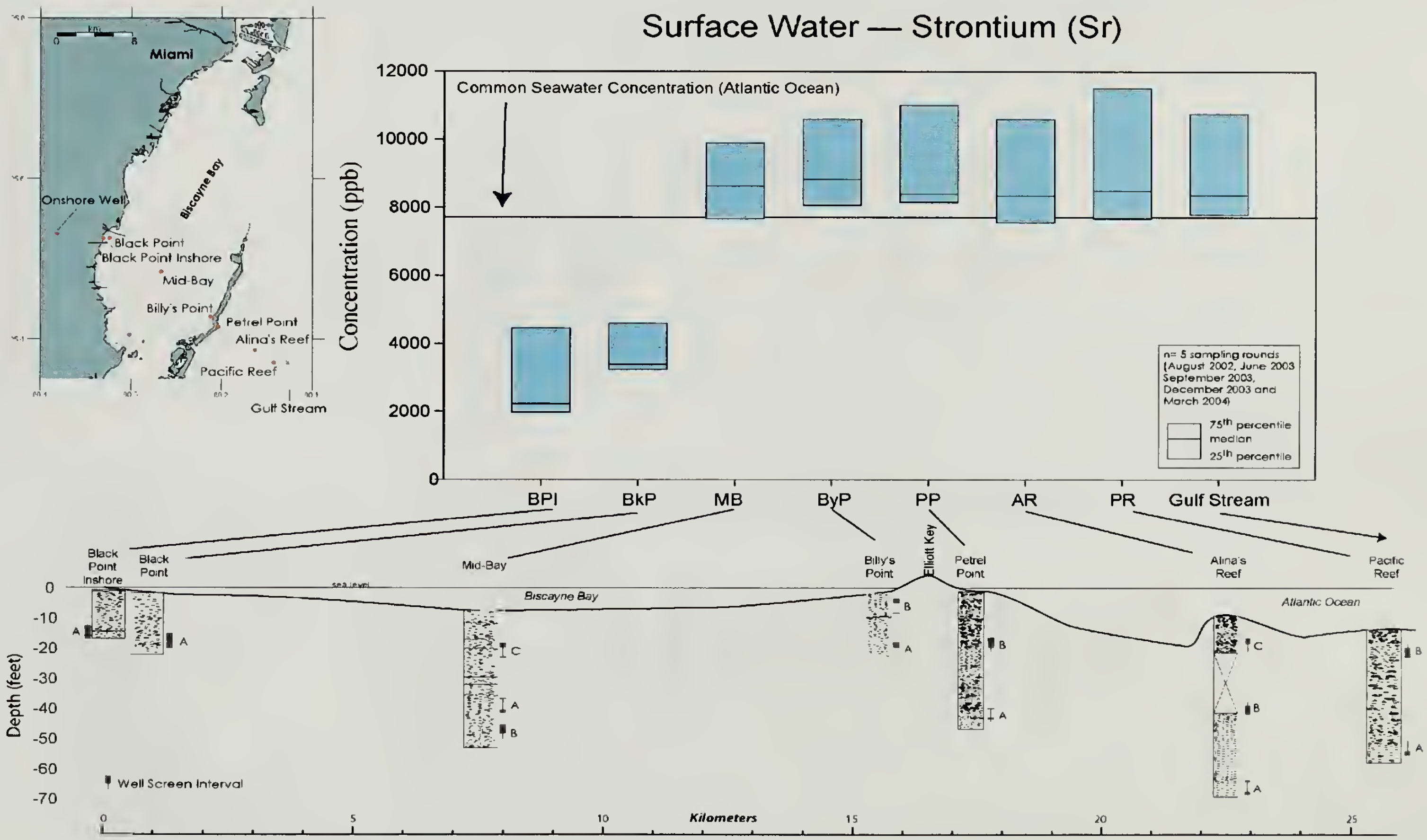


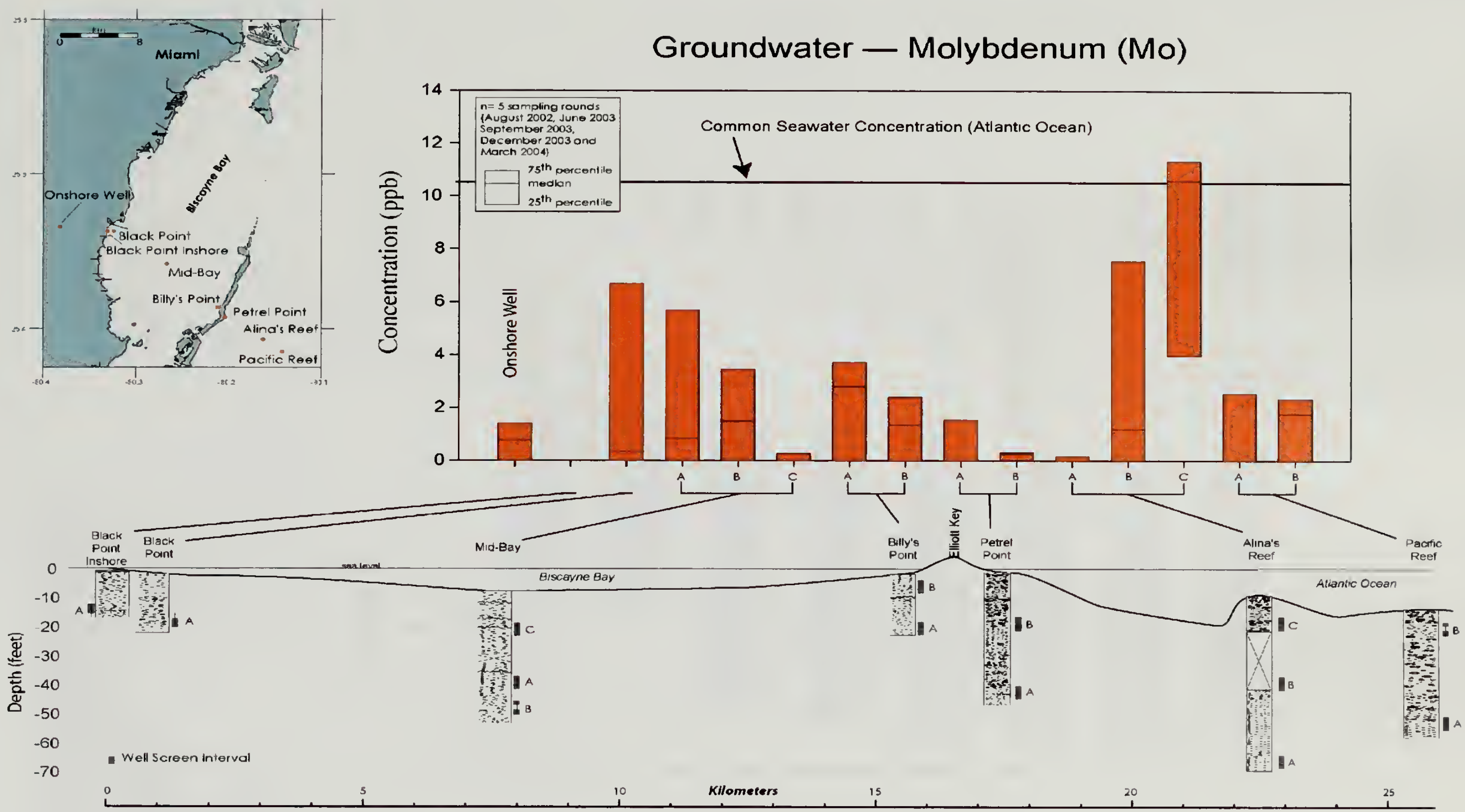
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



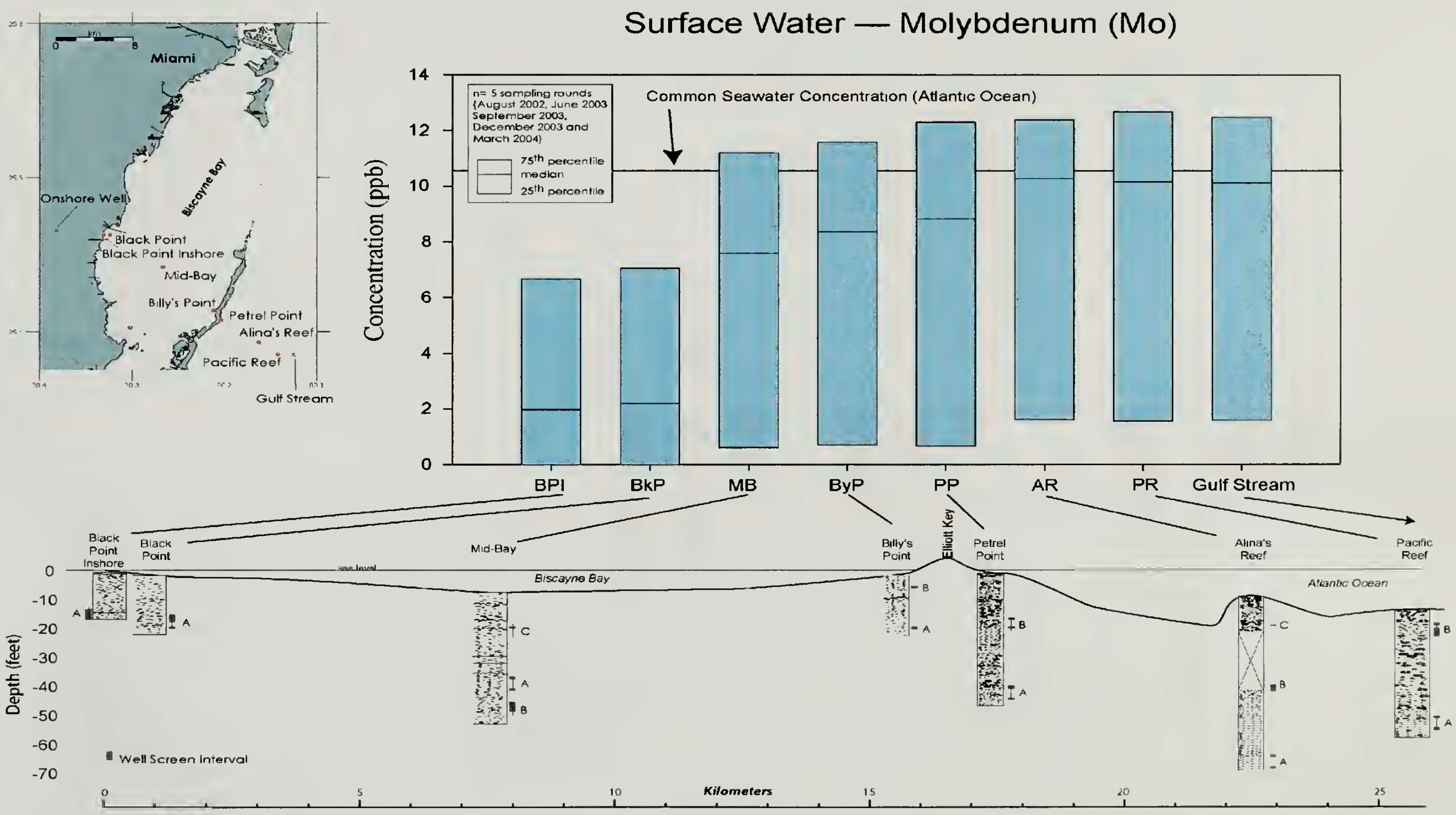
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



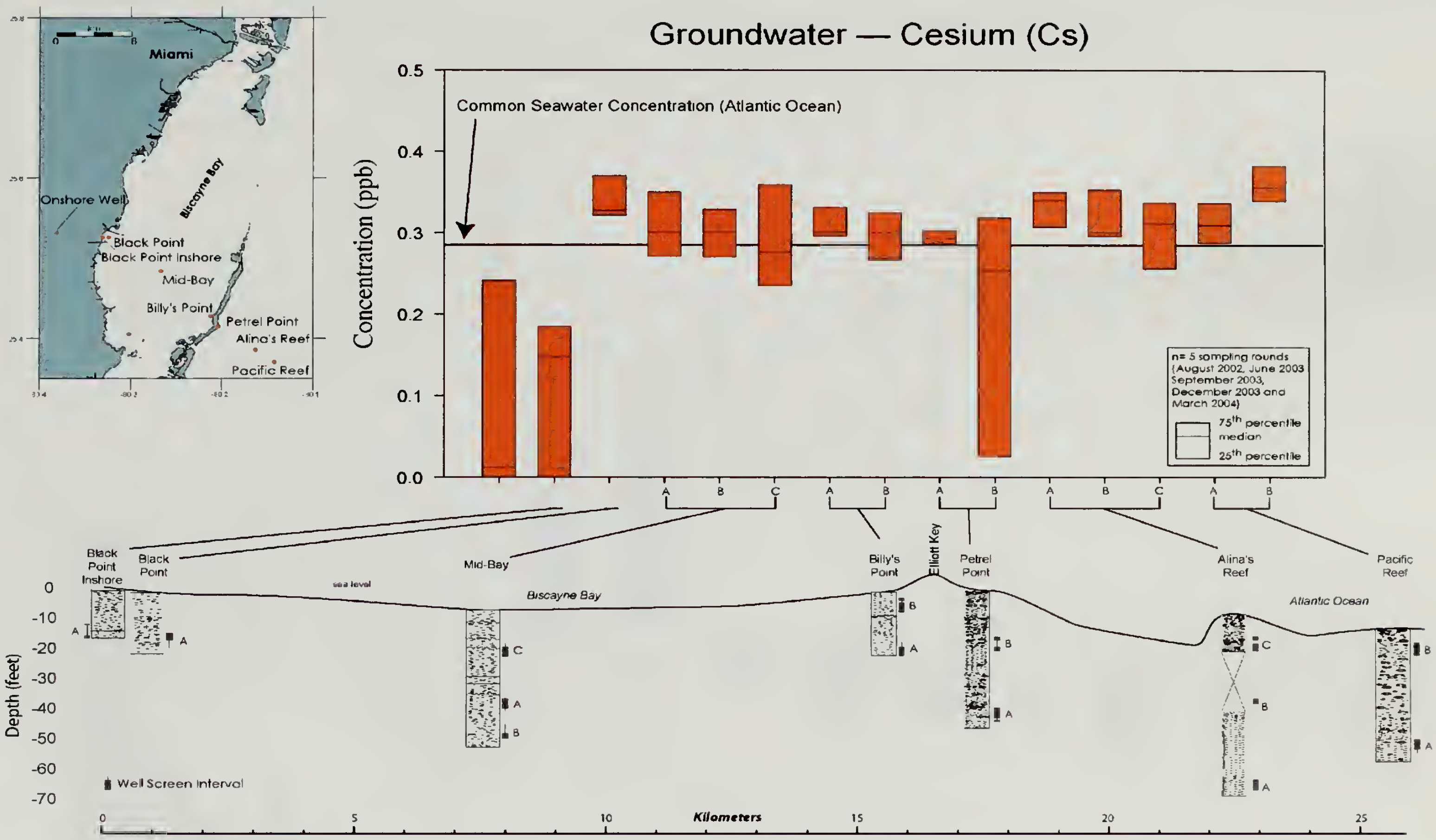
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



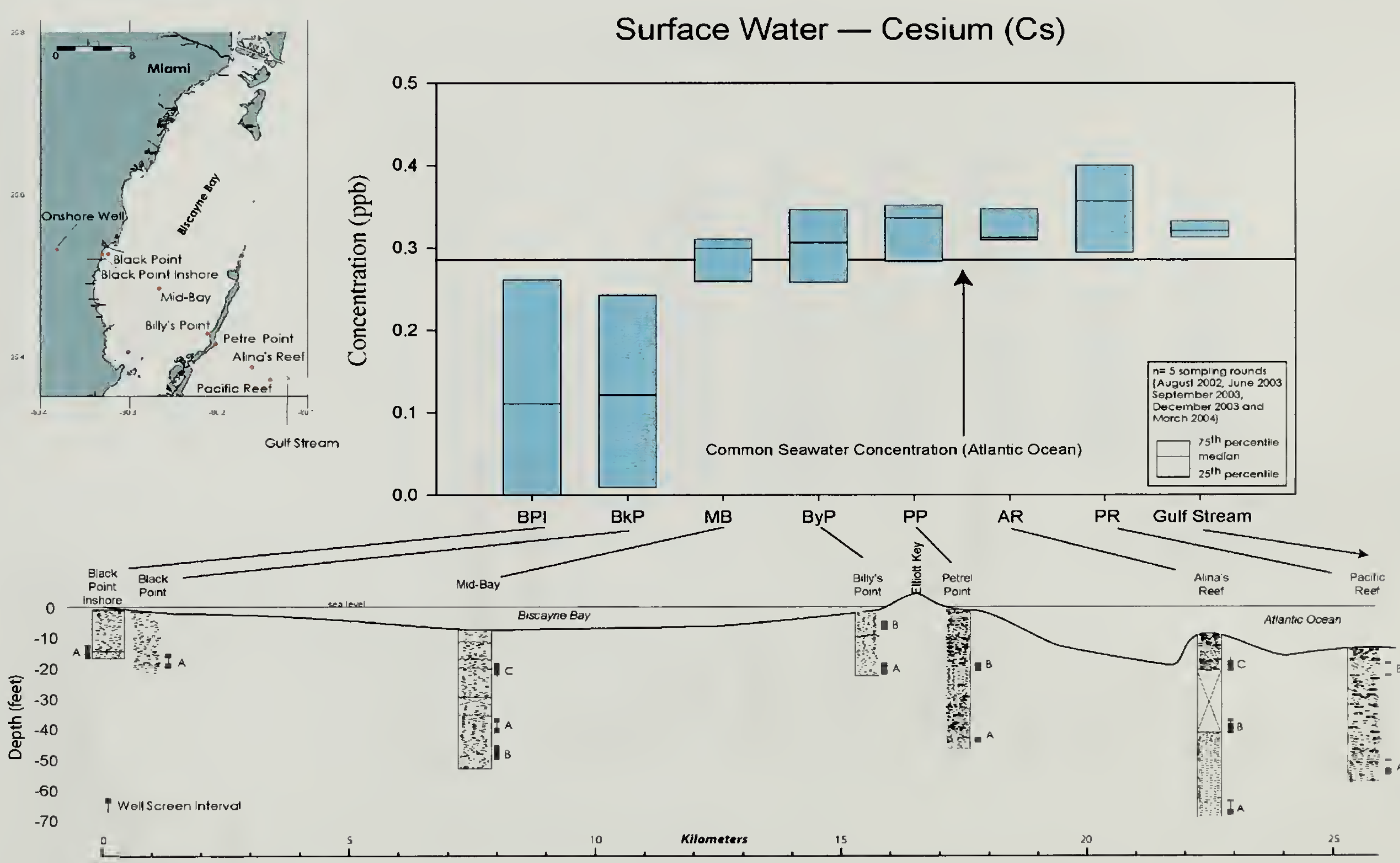
Appendix B3. Trace elements for ground and surface waters in BNP Common seawater values from Millero (1996).



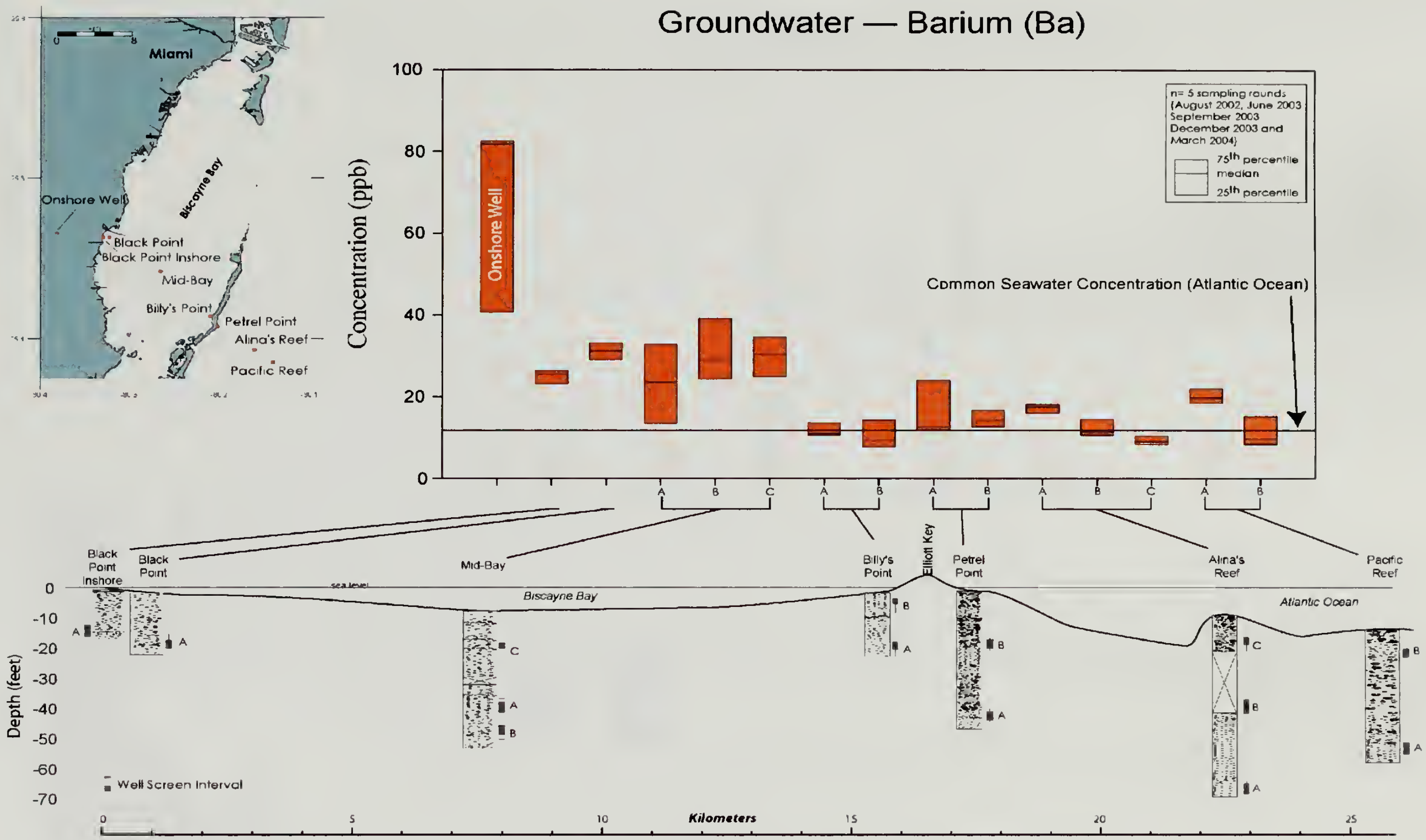
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



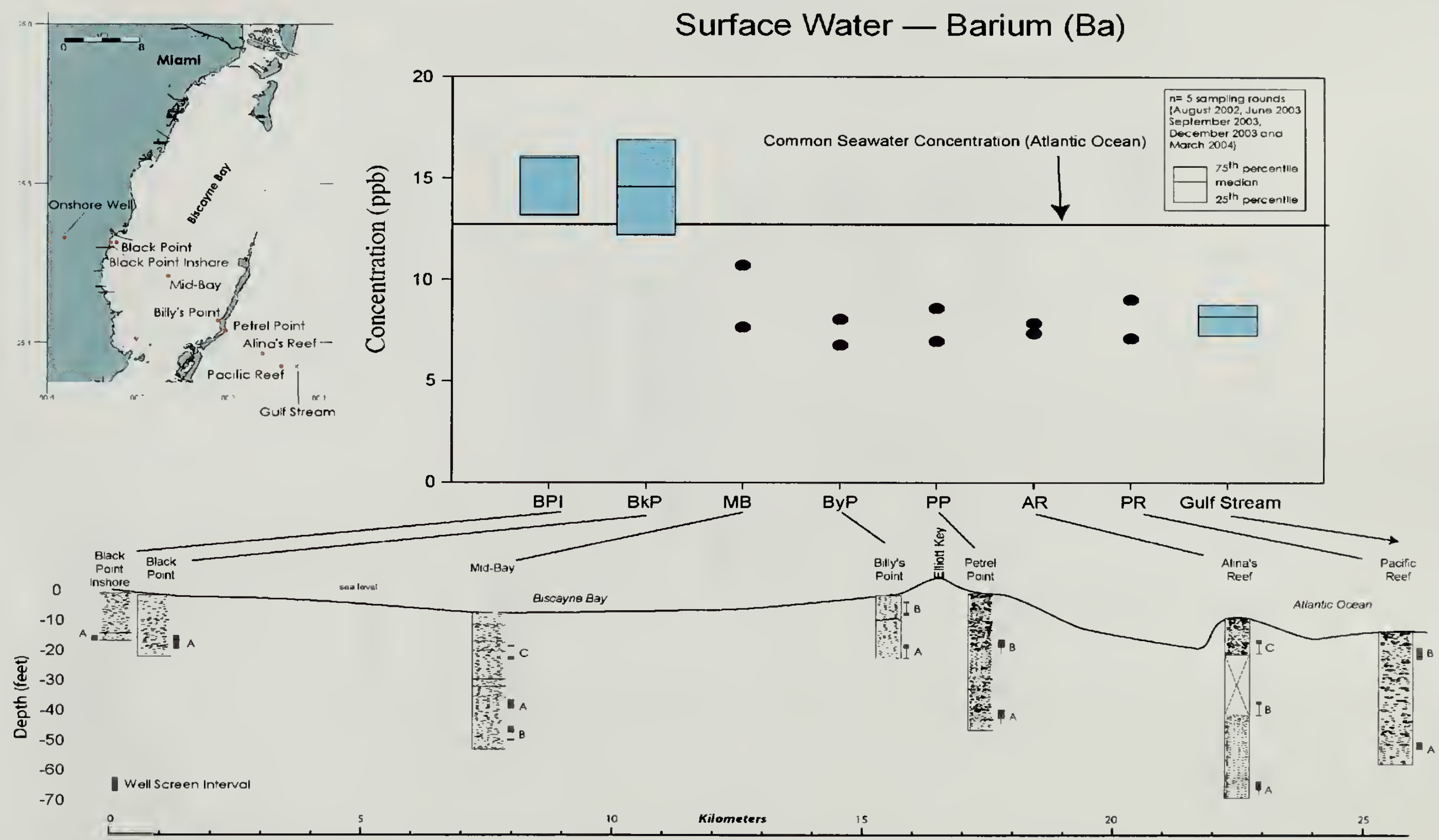
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



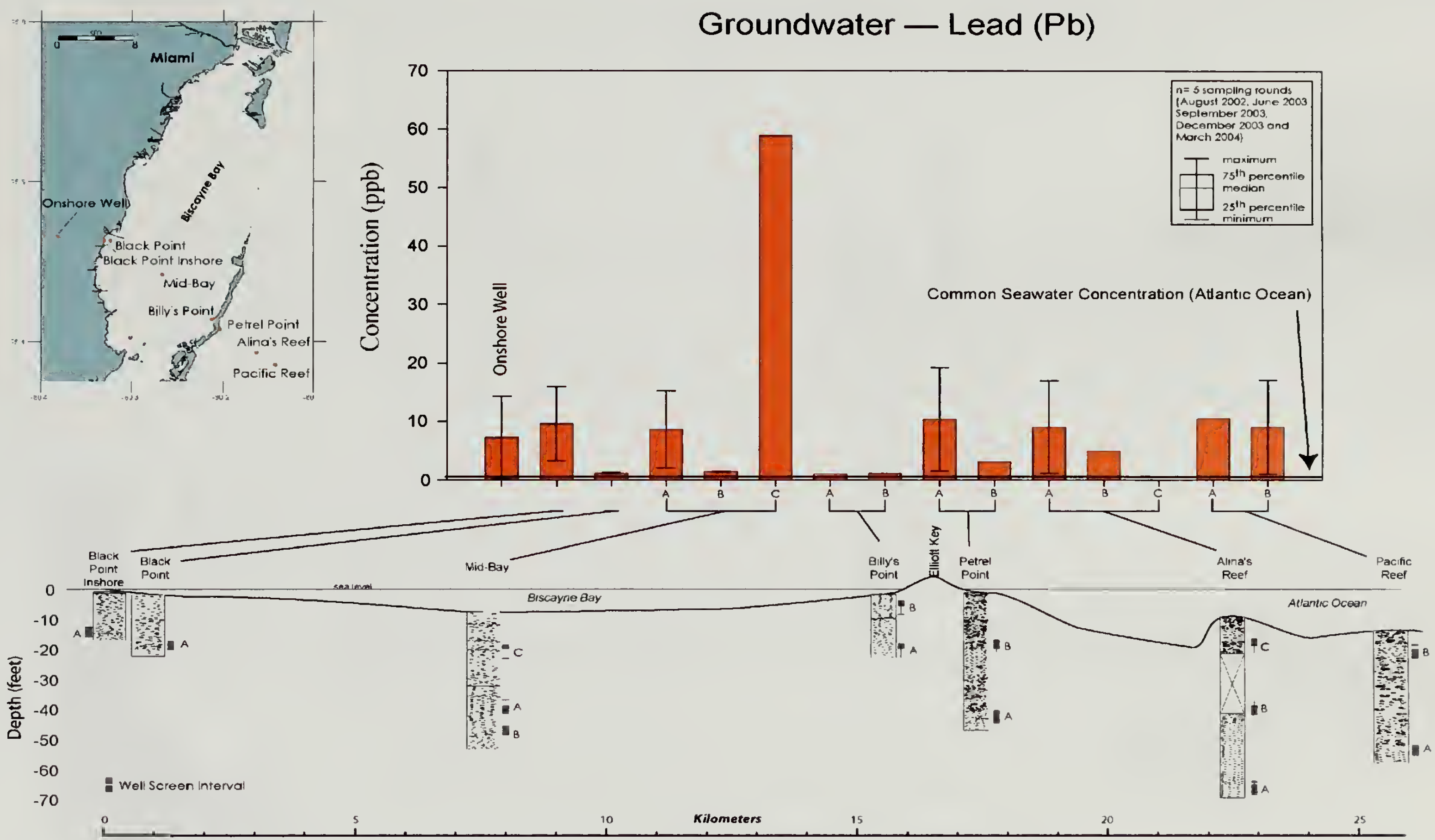
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).



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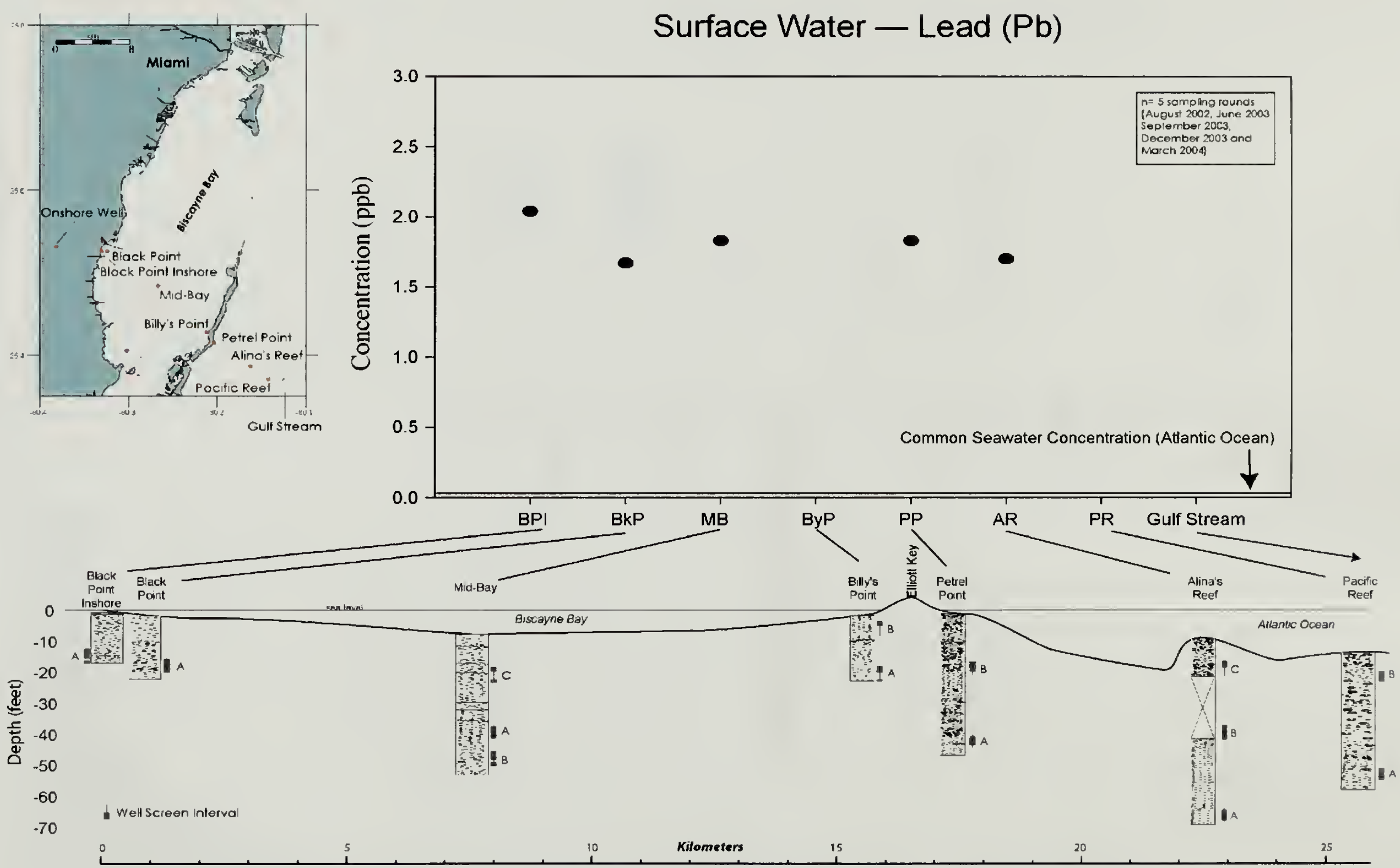


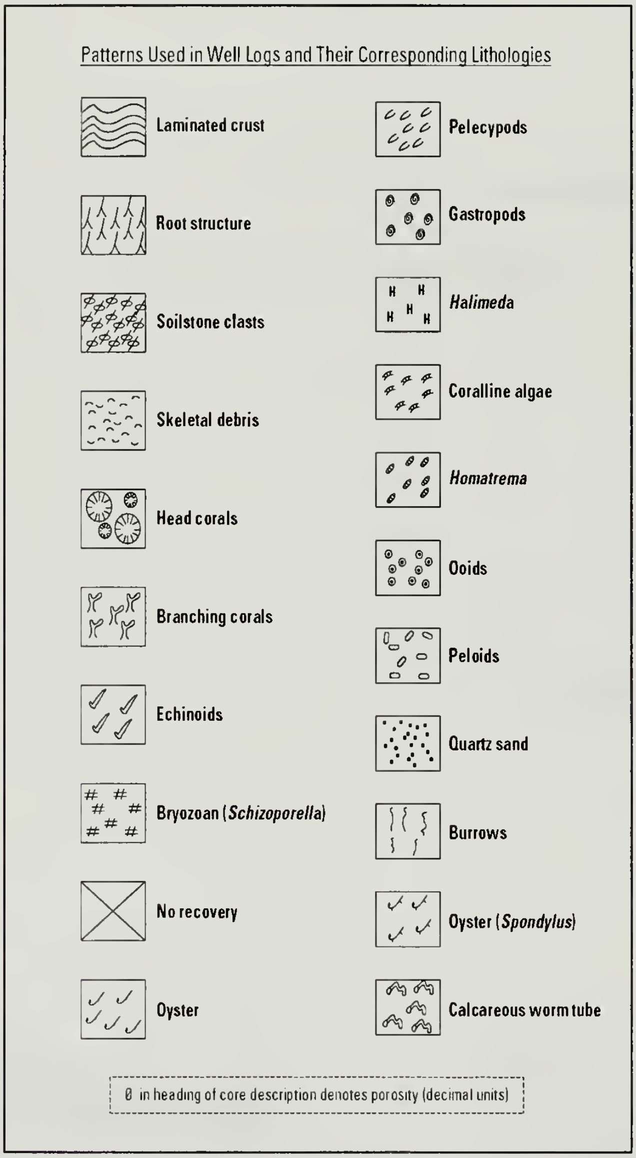
Appendix B3. Trace elements for ground and surface waters in BNP. Common seawater values from Millero (1996).

Appendix C

Lithologic Well Logs

Classification of Carbonate Rocks According to Depositional Texture (after Dunham, 1962)

DEPOSITIONAL TEXTURE RECOGNIZABLE					DEPOSITIONAL TEXTURE NOT RECOGNIZABLE
Original Components not Bound Together During Deposition				Original components were bound together during deposition.. as shown by intergrown skeletal matter, lamination contrary to gravity or sediment-floored cavities that are roofed over by organic matter and are too large to be interstices.	Crystalline Carbonate
Contains mud (particles of clay and fine silt size)			Lacks mud and is grain-supported		(Subdivide according to classifications designed to bear on physical texture or diagenesis.)
Mud-supported		Grain-supported			
Less than 10 percent grains	More than 10 percent grains				
Mudstone	Wackestone	Packstone	Grainstone	Boundstone	



WELL LOG

FORM NO.:	PROJECT NO.:
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Black Point Inshore DATE BEGAN - June 2, 2002 DATE FINISHED - June 2, 2002 GPS: LAT. - 25 31.551' LONG. - -80 19.825'
TOTAL DEPTH: 17 ft ELEVATION (WATER DEPTH): -1 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Located ~100 yards off mangrove shoreline south of Black Point Landfill.
LOGGED BY: Christopher Reich DATE: July 12, 2002 PLOTTED BY: Christopher Reich DATE: July 15, 2001	

Depth **ø** **Cores** **Description - (e.g., lithology, color, fossils, sed. structures, other remarks)**

top

1 m, 5 ft, 2 m, 3 m, 10 ft, 4 m, 15 ft, 5 m, 6 m, 20 ft, 7 m, 25 ft, 8 m

peat, 2-3 inches thick
laminated crust, caliche
tan-grey oolitic limestone, shell debris, calcite crystals throughout core

grainstone (gs)

gs, rubble *(Recovery 0-5ft: 60%)*

8', dense packstone (ps), gray, brown material lining vugs

gs, shells and shell debris in vugs
(Recovery 5-10ft: 30%)
ps

dense ps, gastropods molds, shell imprints
caliche, brown with ~5% rounded to subrounded quartz grains
(Recovery 10-15ft: 30%)
gs, rubble, cream, ~30% quartz, *Halimeda* or Milliolids(?)

sandstone, cemented quartz (~50%), few shells & *Halimeda*/Milliolids(?)
TD 17ft *(Recovery 15-17ft: 80%)*

WELL LOG

FORM NO.:	PROJECT NO.:
PRINCIPLE INVESTIGATOR: **E.A. Shinn**	TITLE: **Wells installed to help in calibrating model that USGS Miami is developing**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Black Point-1A DATE BEGAN - May 10, 1996 DATE FINISHED - May 10, 1996 GPS: LAT - 25 31.572' LONG. - -80 19.457'
TOTAL DEPTH: 20 ft ELEVATION (WATER DEPTH): -2 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Located offshore of Black Point Landfill and south of canal/channel. This core was taken for a previous project.
LOGGED BY: Christopher Reich DATE: March 22, 2002 PLOTTED BY: Christopher Reich DATE: March 22, 2001	

Depth | ø | Cores | Description - (e.g., lithology, color, fossils, sed. structures, other remarks)

top

1 m

5 ft

2 m

3 m 10 ft

4 m

15 ft

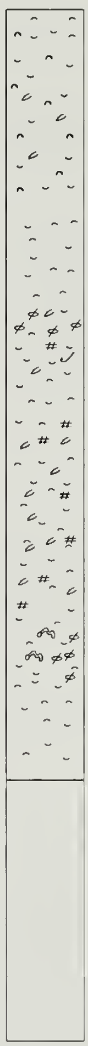
5 m

6 m 20 ft

7 m

25 ft

8 m



grainstone (gs), tan-white, skeletal debris, solution features infilled with gray cement

friable gs, becoming very vuggy below 3ft

Recovery 0-5ft: 30%

disconformity, dense gray limestone, fine grain, no fossils and no laminations
grades into cream-tan dense packstone (ps), bivalve shells, shell molds
moldic porosity, large vugs and vugs infilled with a gray calcite coating

Recovery 5-10ft: 40%

recrystallized bryozoa and shells (coquina)

gs (rubble), cream color, cemented bryozoa (50%) and molluscan and gastropod shells

Recovery 10-15ft: 40%

coquina, cemented molluscan shells (floatstone?), serpulid worm tubes and shell molds
section (6 inches) of coquina with dense gray mudstone

white-cream color gs, shell debris

Recovery 15-20ft: 85%

TD 20ft

WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION- PLACE: - Mid-Bay 1A DATE BEGAN - June 9, 2001 DATE FINISHED - June 10, 2001
TOTAL DEPTH: 45 ft ELEVATION (WATER DEPTH): -8 ft	GPS: LAT - 25.4838 LONG. - -80.2668
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Depth to base of screen is 33' 2"
LOGGED BY: Christopher Reich DATE: July 3, 2001 PLOTTED BY: Christopher Reich DATE: July 6, 2001	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)

top

laminated caliche, black organic material
grainstone (gs), tan-white, skeletal debris

chalky gs, recrystallized shell material

1 m

5 ft

5ft. black brown caliche rubble *Recovery 0-5ft: 30%*
gs

2 m

Packstone (ps) with gs infilled vugs
Calcareous worm tubes, bryozoa, large molluscs (oyster)

3 m 10 ft *Recovery 5-10ft: 20%*

recrystallized bryozoa
brown, laminated caliche
ps (rubble)

4 m

numerous shells in ps rubble *Recovery 10-15ft 30%*

15 ft

black angular sub-angular clast, brown caliche (possible origin is from 11ft)

5 m

ps, chalky white

gs, burrow features lined with lime mud

6 m 20 ft rubble, gs *Recovery 15-20ft: 30%*

gray limestone with root traces, dense mudstone (ms) ps

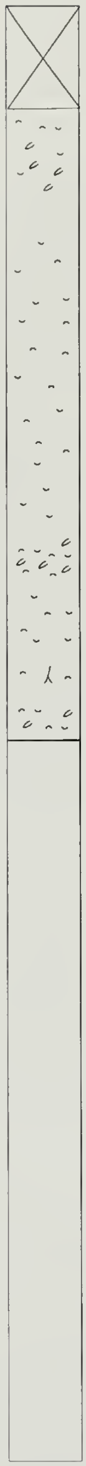
7 m

gray ms & white, chalky ps

25 ft *Recovery 20-25ft 30%*

8 m no recovery, 2.5 to 3ft cavern

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)



8 m

no recovery

9 m 30 ft

ps. gray-brown, small dissolution features *Recovery 25-30ft: 5%*

coquina
dense brown ms. small phosphate sand grains

10 m

35 ft

brown-white ms *Recovery 30-35ft: 20%*

11 m

rubble, ms

Recovery 35-40ft: <5%

12 m 40 ft

coquina piece

13 m

dense ms. micro tubules (root structure)

45 ft

brown ms/ps, shell debris
TD 45ft *Recovery 40-45ft: <5%*

14 m

15 m 50 ft

16 m

55 ft

17 m

18 m 60 ft

19 m

WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Mid-Bay 1B DATE BEGAN - June 11, 2001 DATE FINISHED - June 12, 2001 GPS: LAT. - 25.4838 LONG. - -80.2668
TOTAL DEPTH: 55 ft ELEVATION (WATER DEPTH): -8 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Depth to base of screen is 41' 8"
LOGGED BY: Christopher Reich DATE: July 3, 2001 PLOTTED BY: Christopher Reich DATE: July 17, 2001	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)

top

grainstone (gs), black organic material on surface
tan-white gs with shells
gs ps
black lithoclasts, shell debris

1 m

gs, numerous shells (recrystallized) *Recovery 0-5ft 95%*

5 ft

laminated caliche
ps, rubble, bryozoa, molluscs

2 m

gastropod *Recovery 5-10ft 30%*
coquina, bryozoans,

3 m 10 ft

brown lithoclasts
laminated caliche
dense ps

4 m

rubble, black pebbles/lithoclasts

numerous shells, molluscs *Recovery 10-15ft 30%*
laminated caliche
dense ps, tan-white with brown gs infilling vugs

15 ft

5 m

6 m 20 ft

Recovery 15-20ft 90%

chalky white ps, rubble

gray to gray-brown limestone, geopetal structures, calcite formation in small vugs, gastropods

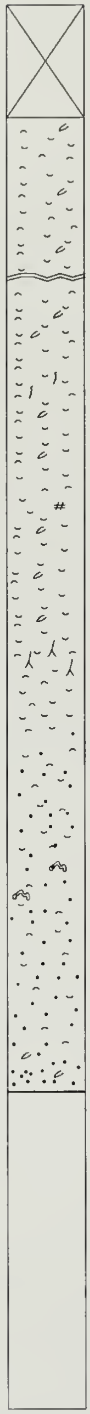
7 m

25 ft

Recovery 20-25ft 93%
ps, numerous shells and shell imprints
coquina

8 m

Mid-Bay 1B

Depth	ø	Cores	Description - (e.g., lithology, color, fossils, sed. structures, other remarks)	
8 m				
9 m 30 ft			dense brown ms, shell debris is recrystallized	*Recovery 25-30ft < 5%*
10 m				
35 ft				*Recovery 30-35ft < 5%*
			slightly more chalky, mottled brown-white ps/ms	
11 m			burrow structures, very small	
			gs, white chalky with brown ps in vugs	
12 m 40 ft			coquina, cemented shell material, friable, rubbly, bryozoa	*Recovery 35-40ft 60%*
13 m			gray ps, white gs infilling, root structures	
45 ft				*Recovery 40-45ft 30%*
14 m			ps, brown to tan, quartz grains (~40%)	
			calcareous worm tubes	
15 m 50 ft				*Recovery 45-50ft < 5%*
			rubble	
16 m			80% cemented quartz	
			quartz sand, unconsolidated with molluscan fragments TD 55ft	*Recovery 50-55ft < 5%*
55 ft				
17 m				
18 m 60 ft				
19 m				

WELL LOG

FORM NO.	PROJECT NO. 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Mid-Bay 1C DATE BEGAN - June 13, 2001 DATE FINISHED - June 13, 2001 GPS: LAT. - 25.4838 LONG. - -80.2668
TOTAL DEPTH: 15 ft ELEVATION (WATER DEPTH). -8 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Depth to base of screen is 15'
LOGGED BY: Christopher Reich DATE: July 2, 2001 PLOTTED BY: Christopher Reich DATE: July 17, 2001	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)

top

blackened crust, highly bored
white grainstone (gs), shells, angular black lithoclasts
tan gs/packstone (ps), shell debris some recrystallized

1 m

5 ft

gray ps, recrystallized *Recovery 0-5ft 100%*
laminated brown caliche
ps with molluscan shells, rubbly down to 9ft
gs/ps, white

2 m

shells, shell imprints, bryozoa, gastropods, calcareous worm tubes

3 m 10 ft

Recovery 5-10ft, 50%

coquina, cemented large molluscan shells
brown/black angular lithoclasts

ps, dense, gs (tan) infilling vugs
gs, chalky, friable, vuggy, gray-brown caliche in vugs

4 m

dense ps, tan with brown ps/gs infilling
tight zone from 13-15ft, shell debris, recrystallized, calcareous worm tubes, black angular lithoclasts
increase in shell material at base of core *Recovery 10-15ft 95%*
TD 15ft

15 ft

5 m

6 m 20 ft

7 m

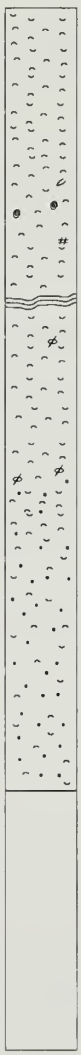
25 ft

8 m

WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Billy's Point 1A DATE BEGAN - June 6, 2001 DATE FINISHED - June 7, 2001 GPS: LAT. - 25.4279 LONG. - -80.2124
TOTAL DEPTH: 20 ft ELEVATION (WATER DEPTH): -2 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Most offshore well. Depth to base of screen is 21' 6"
LOGGED BY: Christopher Reich DATE: July 2, 2001 PLOTTED BY: Christopher Reich DATE: July 6, 2001	

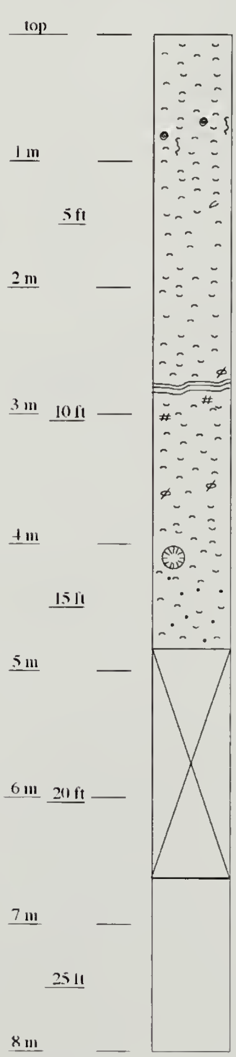
Depth	ø	Cores	Description - (e.g., lithology, color, fossils, sed. structures, other remarks)	
top			tan-white grainstone(gs), gray interstitial sediments	
1 m			gs/packstone(ps) friable material in vugs (shell debris)	
5 ft			coquina, gs matrix, gastropods	*Recovery 0-5ft: 100%*
			bryozoa in gs	
2 m				
			laminated caliche crust	
			ps, solution features filled with caliche gs, vuggy, tan, fine sediments in vugs	
3 m 10 ft				*Recovery 5-10ft: 100%*
			brown lithoclasts in ps, quartz (~20%)	
4 m			grade from ps to quartz calcarenite (>50% quartz grains), cross bedded(?)	
15 ft				*Recovery 10-15ft: 40%*
5 m				
6 m 20 ft			TD 20ft	*Recovery 15-20ft: 20%*
7 m				
25 ft				
8 m				



WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION PLACE - Billy's Point 1B DATE BEGAN - June 8, 2001 DATE FINISHED - June 9, 2001 GPS: LAT. - 25.4279 LONG. - -80.2124
TOTAL DEPTH 22 ft ELEVATION (WATER DEPTH): -2 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Most offshore well. Depth to base of screen is ~6'
LOGGED BY: Christopher Reich DATE: July 2, 2001 PLOTTED BY: Christopher Reich DATE: July18, 2001	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)



~3 inches of surface sediment/turtle grass
ps. brown-gray. shell material

gastropods. burrows infilled/lined with mud

Recovery 0-5ft: 100%

coquina. gs matrix

brown lithoclasts. caliche crust
bryozoa

Recovery 5-10ft: 60%

white-tan ps with gs infilling

Montastrea sp. leached/recrystallized in ps matrix
cross-bedded cemented shell material (~50% quartz grains)

Recovery 10-15ft: 50%

no recovery, unconsolidated quartz/lime mud

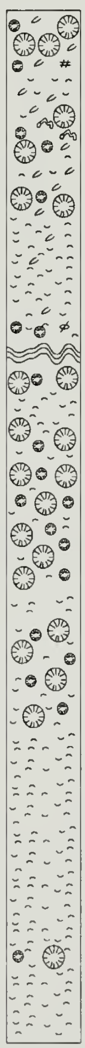
TD 22ft

WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Petrel Point 1A DATE BEGAN - June 5, 2001 DATE FINISHED - June 6, 2001 GPS - LAT - 25.415 LONG. - -80.2036
TOTAL DEPTH: 45 ft ELEVATION (WATER DEPTH): -2 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Depth to base of screen is 42'
LOGGED BY: Christopher Reich DATE: June 29, 2001 PLOTTED BY: Christopher Reich DATE: July 18, 2001	

Depth | ø | Cores | Description - (e.g., lithology, color, fossils, sed. structures, other remarks)

top



Montastrea annularis, pholad borings
Colpophyllia sp. skeletal debris
bryozoa
grainstone(gs), white with brown skeletal infilling

M. annularis, calcareous worm tubes, pholads

1 m

vuggy gs/packstone(ps), recrystallized shells — *Recovery 0-5ft: 100%*

5 ft

M. annularis, pholad borings
gs, yellow material (calcite) in vugs

2 m

coquina with brown caliche mudstone (ms), *M. annularis*, blackened grains

laminated caliche crust on top of *M. annularis* which has been recrystallized and somewhat leached

3 m 10 ft

ps, *M. annularis* fragments — *Recovery 5-10ft: 60%*
white-brown ps
M. annularis, heavily leached along annular bands (recrystallized)

4 m

yellow-brown calcite (?) appears in vugs (similar to that found at 6ft)
Recovery 10-15ft: 60%

15 ft

white chalky gs, rubble
M. annularis, slightly recrystallized in gs matrix

5 m

rubble gs, white, yellow (at times almost black) calcite in vugs (19ft to 23ft)
Recovery 15-20ft: 100%

6 m 20 ft

7 m

Recovery 20-25ft: 30%

25 ft

M. annularis rubble

gs, white-gray, shell debris

8 m

Petrel Point 1A

Depth | ø | Cores | Description - (e g , lithology, color, fossils, sed structures, other remarks)

8 m
9 m 30 ft
10 m
35 ft
11 m
12 m 40 ft
13 m
45 ft
14 m
15 m 50 ft
16 m
55 ft
17 m
18 m 60 ft
19 m

M. annularis, recrystallized

Recovery 25-30ft 30%

gs
M. annularis, slightly recrystallized leached, pholad borings filled with gs

mollusean shell (*Spondylus*) in gs, shells recrystallized

M. cavernosa, leached/recrystallized

Recovery 30-35ft 100%

coquina

Colpophyllia sp
M. annularis, pholads infilled with lime mud

Diploria sp. rubble *Recovery 35-40ft 30%*
ps. white-gray, 40% quartz grains

ps. gray, coquina deposit, all shells leached, imprints and secondary porosity
possible unconformity-brown caliche with 40% quartz in ps matrix

coquina (80% shells, cemented with quartz some of which are black)

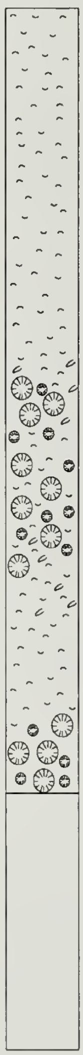
Recovery 40-45ft 30%

TD 45ft

WELL LOG

FORM NO.	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Petrel Point 1B DATE BEGAN - June 6, 2001 DATE FINISHED - June 6, 2001 GPS: LAT. - 25.415 LONG - -80.2036
TOTAL DEPTH: 20 ft ELEVATION (WATER DEPTH): -2 ft	
DRILLING SYSTEM **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 2-inch pvc with 5-ft well screen. Depth to base of screen is 20' 6"
LOGGED BY: Christopher Reich DATE: June 29, 2001 PLOTTED BY: Christopher Reich DATE: July 18, 2001	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)



top — grainstone (gs), white-tan

vuggy

1 m

5 ft — *Recovery 0-5ft: 80%*

yellowish material in vugs of gs (5-9ft)

2 m

packstone (ps), *Montastrea* sp. shells — *Recovery 5-10ft: 80%*

3 m 10 ft — *Montastrea* leached & recrystallized in ps matrix, shell material

Colpophyllia, leached recrystallized

4 m

15 ft — gs, white, yellowish calcite in vugs — *Recovery 10-15ft: 80%*

5 m

Montastrea sp. recrystallized, pholads

Recovery 15-20ft: 10%

6 m 20 ft — TD 20ft

7 m

25 ft

8 m

WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Alina's Reef 1A DATE BEGAN - June 14, 2001 DATE FINISHED - June 15, 2001 GPS: LAT. - 25.3862 LONG - -80.1629
TOTAL DEPTH: 60 ft ELEVATION (WATER DEPTH): -9 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring wells installed, used 1-inch pvc with 5-ft well screen. Multi-depth nested well site. Well A is taller (60ft) than Well B (32ft).
LOGGED BY: Christopher Reich DATE: June 29, 2001 PLOTTED BY: Christopher Reich DATE: July 19, 2001	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)

top

1 m

5 ft

2 m

3 m 10 ft

4 m

15 ft

5 m

6 m 20 ft

7 m

25 ft

8 m

Holocene reef deposit--*Montastrea annularis* corals with pbolad borings and pbolad sbells {^{14}C sample AR1A @ 3inches from top–1796 yBP, corrected}

Homatrema (red)
rubble *M. annularis*, skeletal debris, bryozoa

large oyster (*Spondylus?*), *Homatrema*, interstial mud and skeletal debris

Recovery 0-5ft 70%

Diploria sp. numerous pholad borings/shells-fibrous organic material (tan-brown) in pholad borings with lime mud
vuggy grainstone (gs), some large with interstial mud, shells, *Halimeda*, bryozoa, calcarous worm tubes

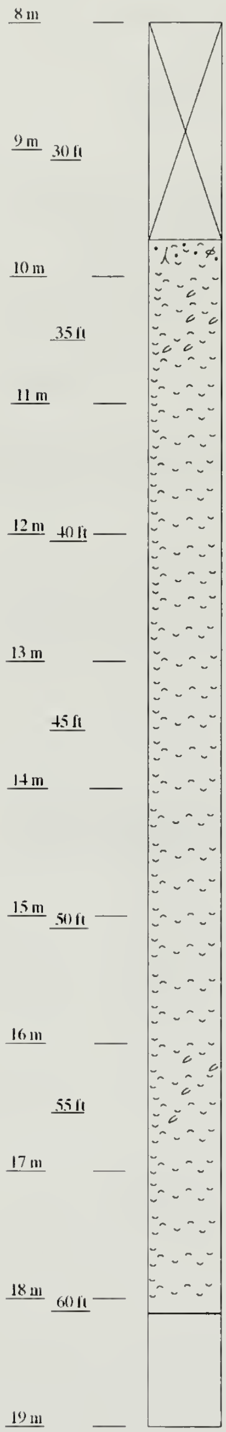
M. cavernosa

Recovery 5-10ft 60%

numerous pholad borings, worm tubes, *Homatrema*, black organic fibrous material
{^{14}C sample AR1B @ 10 ft from top=2997 yBP, corrected}

no recovery-unconsolidated lime mud and sand

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)



no recovery

tan mudstone (ms), chalky, caliche lithoclasts (some blackened/angular), quartz sand (<10%) brown caliche, root traces, dessication cracks (?)

shell material/debris *Recovery 30-35ft 40%*

ms rubble

grading into chalky packstone (ps) with lime mud in vugs

Recovery 35-45ft <5%

Recovery 45-50ft <5%

friable, chalky ms

shell debris/material

Recovery 50-55ft <5%

ps, cream-tan, rubble

TD 60ft *Recovery 55-60ft <5%*

WELL LOG

FORM NO.	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION PLACE - Alina's Reef 1C DATE BEGAN - June 16, 2001 DATE FINISHED - June 16, 2001 GPS: LAT - 25.3862 LONG. - -80.1629
TOTAL DEPTH: 13 ft ELEVATION (WATER DEPTH): -9 ft	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Monitoring well installed, used 1-inch pvc with 5-ft well screen. Well site is ~20ft SE of Alina's Reef 1A well nest. Screen set at ~12ft below subsurface.
LOGGED BY: Christopher Reich DATE: June 28, 2001 PLOTTED BY: Christopher Reich DATE: July 18, 2001	

Depth ø Cores Description - (e g., lithology, color, fossils, sed structures, other remarks)

top

1 m

5 ft

2 m

3 m 10 ft

4 m

15 ft

5 m

6 m 20 ft

7 m

25 ft

8 m

Grainstone (gs)/packstone (ps). *Homatrema*, shell debris, interstitial sediment & mud

Montastrea annularis, pholad borings
Spondylus

Recovery 0-5ft 30%

M. annularis, pholad borings, shell debris
Colpophyllia sp
M. annularis, vugs contain shell debris, *Halimeda*

Colpophyllia sp with intersected layers of gray-white lime mud

Recovery 5-10ft: 90%

bryozoa
organic fibrous material in vugs, skeletal gs with mud infilling vugs

large pholad in gs/mudstone (ms)
becoming very muddy, gs with mud lining walls of core

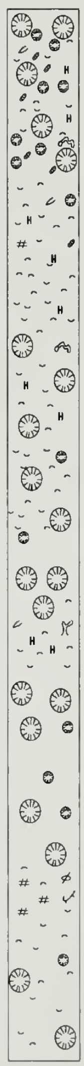
Recovery 10-13ft: 90%

TD 13ft

WELL LOG

FORM NO.:	PROJECT NO.: 9472-32032
PRINCIPLE INVESTIGATOR: **R.B. Halley**	TITLE: **Subsurface pathways for pollutant transport: Biscayne Bay**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Pacific Reef DATE BEGAN - May 30, 2002 DATE FINISHED - June 1, 2002 GPS: LAT. - 25° 22.241 LONG. - -80° 08.539
TOTAL DEPTH: 42 ft ELEVATION (WATER DEPTH) -12'	
DRILLING SYSTEM: **NQ2 WIRELINE SYSTEM, HYDRAULIC ROTARY DRILL**	REMARKS: Well site located ~50 yards south of structure at Pacific Reef. Two 1-inch-diameter wells in same borehole.
LOGGED BY: Christopher Reich DATE: July 12, 2002 PLOTTED BY: Christopher Reich DATE: July 15, 2002	

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)



top — *Montastrea annularis* corals with pholad borings and pholad shells

Homatrema (red)
grainstone rubble, skeletal debris, bryozoa, worm tubes, *Halimeda*
coral rubble infilled with lime mud

1 m — coral and gs rubble

5 ft

2 m

3 m 10 ft

4 m

15 ft — *Diploria* sp. very dense (recrystallized to calcite), top infilled with shell debris and lime mud (w geopetal structures in pholad bore holes), geopetals have micro laminae(?)
Acropora cervicornis, *M. annularis* rubble, pholads, *Halimeda* shell debris

5 m

M. annularis is encrusted with a white coralline algae(?)

6 m 20 ft — rubble, *M. annularis*

caliche crust (no laminations)
debris, pink & white bryozoa, *Spondylus* oyster shells, caliche infillings along boundary between coral and debris

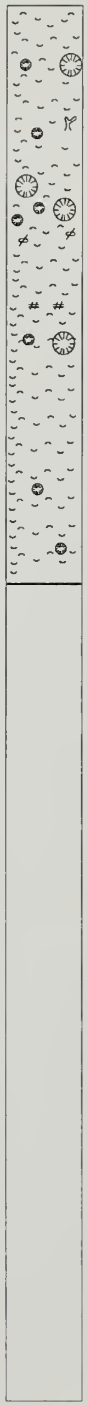
7 m

25 ft

8 m — pockets of gs and shell debris

Pacific Reef

Depth ø Cores Description - (e.g., lithology, color, fossils, sed. structures, other remarks)



8 m

chalky and friable gs in coral vugs
Diploria sp infilled with gs and lime mud, bryozoa and shell debris in vugs

9 m 30 ft

A. cervicornis

M. annularis, growth interrupted by ps (lime mud) within a 1-ft section
caliche crust

10 m

35 ft

gs, bryozoa
M. annularis

11 m

12 m 40 ft

rubbly white ps, coral pieces

white encrusting coralline algae(?)
M. annularis
TD 42ft

13 m

45 ft

14 m

15 m 50 ft

16 m

55 ft

17 m

18 m 60 ft

19 m

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

BISC D-289